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ARCHEOLOGICAL INVESTIGATIONS AT 3MR80-AREA D IN THE RUSH DEVELOPMENT AREA, BUFFALO NATIONAL RIVER, ARKANSAS VOL.II

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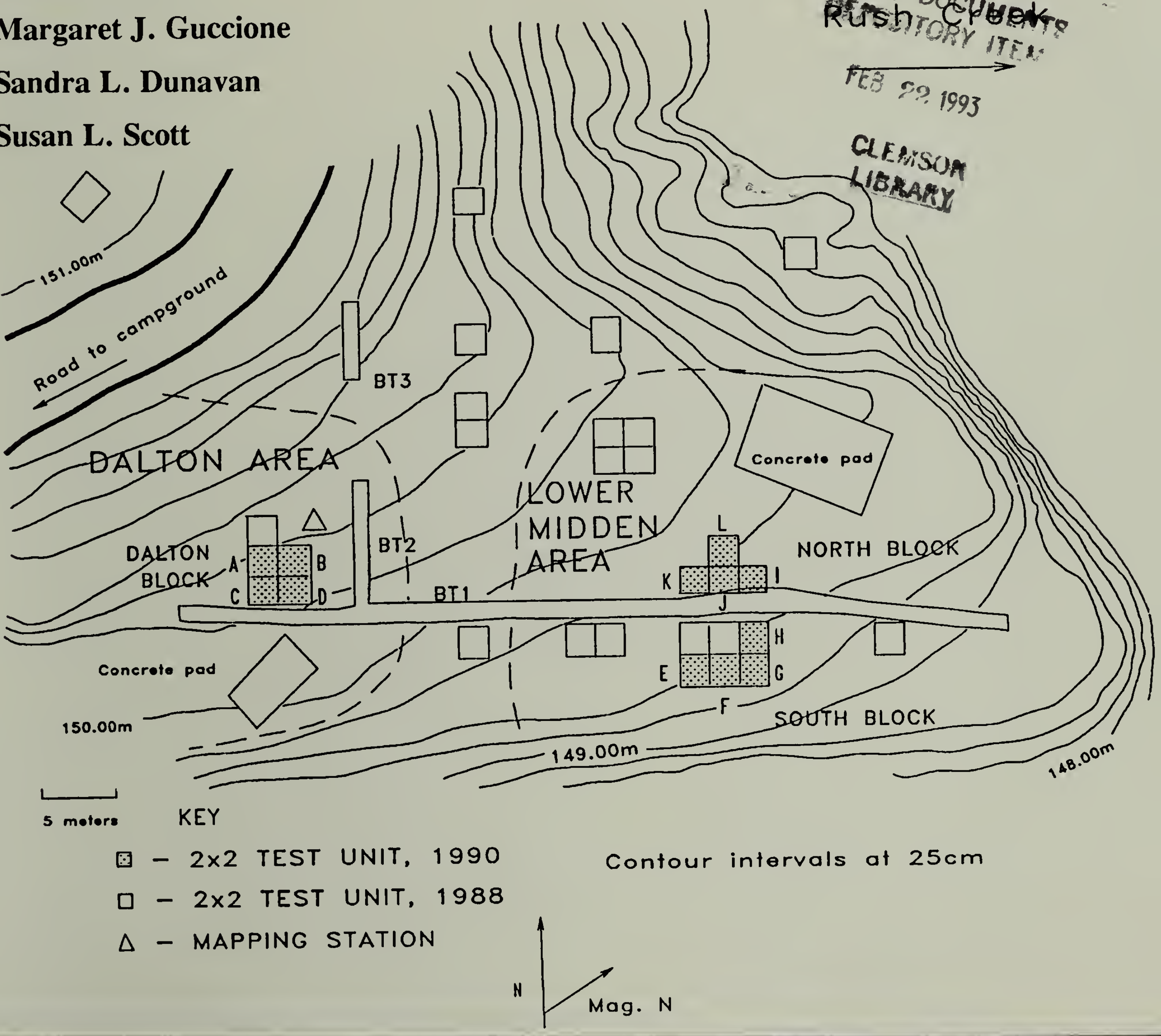

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ARCHEOLOGICAL INVESTIGATIONS AT 3MR80-AREA D IN THE RUSH DEVELOPMENT AREA, BUFFALO NATIONAL RIVER, ARKANSAS VOL II

by

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ABSTRACT

This report documents the results of a second season of investigations conducted at the Dirst Site (3MR80-Area D), a stratified multicomponent site in the Rush Development Area of the Buffalo National River. This work was performed by the Arkansas Archeological Survey's Sponsored Research Program from September to November 1990 under a cooperative agreement between the National Park Service, Southwest Region and the University of Arkansas System, Arkansas Archeological Survey. Planned expansion of the Rush Campground necessitated additional data recovery excavations to mitigate the adverse impacts to significant archeological deposits identified in two discrete locations during the first seasons investigations. Excavations were conducted primarily in a Dalton/Early Archaic component and a separate Middle to Late Woodland midden component, with very limited investigation of an Early Woodland component and a Late Archaic component underlying the midden. Specialized studies of the lithic and ceramic artifacts, preserved floral and faunal remains and radiometric assays provided techno-functional reconstructions for each component. Additional analyses were conducted to place the site in its local and regional context and to examine temporal trends in social and technological innovation that mark the transition from a mobile foraging cultural adaptation to a sedentary cultural adaptation in the Ozarks. A synthetic geomorphological study of the river valley that modeled the known and predicted locations of buried archeological deposits complements both the archeological objectives at the Dirst Site and the future management of archeological resources in the Buffalo National River.

ACKNOWLEDGEMENTS

This project would not have been possible without the help of many individuals. The excavations were directed by Dr. Charles R. Ewen (Principal Investigator), and myself. Dr. Ewen was responsible for the scientific direction of the analysis, and as Research Administrator of the Sponsored Research Program, was also responsible for the administrative oversight of the project. The field crew consisted of Robert Meyers, Mark Medley, Milton Hughes, David Saunders and Don Tatum. The skill and dedication of this crew was largely responsible for the success of this project. In addition to their excavation duties, Meyers and Medley also shared responsibility as tour guides.

Laboratory processing was supervised by Jim Barnes. The laboratory crew at various times consisted of Amanda Huber, Corkey Davis, Paula Frazer, Andrea Geer, Teri Tucker, Suzanne McCaleb, Deborah Weddle, Tracy Holland, Aaron Coleson, Don Tatum, David Saunders and Dawn Jones. Amanda Huber, Suzanne McCaleb and Susan Moorehead entered DELOS data and edited printouts. Jami Lockhart programed the DELOS data manipulations and was especially helpful during the analysis.

Specialized analyses - so central to this interdisciplinary effort - were conducted by outside consultants Sandra L. Dunavan, University of Michigan, who completed the ethnobotanical study of selected samples from the features, and Susan L. Scott, Scott and Associates, who analyzed associated faunal materials. The continuity and insights these two scholars brought to the analysis of the Dirst materials is sincerely appreciated. Dr. Margaret J. Guccione, University of Arkansas, was again called upon to apply her geomorphological research in the Buffalo River Valley in the service of archeology. Her model is a significant contribution to the understanding of the formation of the archeological record in the valley that will be of value to all future studies in the area. Dr. George Sabo III contributed the synthetic chapter of this report, drawing on his formidable knowledge of the archeology of the Ozarks and bringing to a conclusion a profitable line of inquiry he initiated at the Dirst Site in 1988. He was assisted by Jami Lockhart in GIS manipulations of site data that contributed important insights into the prehistoric site selection process along the river.

The draft report was reviewed by Dr. Walter Wait and Dr. George Sabo. Their editorial comments and suggestions have substantially benefited this final version. The report production of both the draft and the present manuscript was ably completed by Ronda Henderson, secretary of the Sponsored Research Program.

The 1990 excavations were truly an exercise public archeology. We were aided in our fieldwork by an extensive contribution of effort from both interested local individuals and by members of the Arkansas Archeological Society. Individuals who assisted at Dirst Site were: Ron Rae, Louis Baker, Mary Farmer Larry Porter, Madge Smith, Bob Hudson, Ann Thurston-Rogers, Julian Cranfill, Ed White, Patsy White, Stacey Zietz, David Jeane, Bille Woods, Michael French, Ann Early, Leslie Newell, Janice Dent, Ralph Jardine, Pearl Jardine, Anna Parks, Joan Pottinger, Charlie Kading, Skip Stewart-Abernathy, Judith Stewart-Abernathy, Benjamin Stewart-Abernathy, Michael Stewart-Abernathy, Greg Peltz, Charla Mann, Chris Mann, James Mann, Bryan Farmer, Bill Beaber and Steve Broskovak.

We also wish to thank Dr. Charles R. McGimsey III, Hester A. Davis and Dr. W Fredrick Limp of the Arkansas Archeological Survey for negotiation of the cooperative agreement and for their assistance during both seasons of work at the Dirst Site. Finally, we would like to thank Dr. Walter Wait and Ron Ice of the National Park Service, Southwest Region, and Jack Linahan, Jim Liles and Myra Dec of the Buffalo National River for making the investigations possible. Their interest and support is sincerely appreciated.

Randall L. Guendling

CONTENTS

CHAPTER 1. Project Background 1
Randall L. Guendling

CHAPTER 2. 1990 Project Objectives 7
Randall L. Guendling
George Sabo III

CHAPTER 3. Field and Laboratory Methods 13
Randall L. Guendling
George Sabo III

CHAPTER 4. Geomorphology of the Buffalo River 23
Margaret J. Guccione

CHAPTER 5. The Archeology of the Dalton Area 57
Randall L. Guendling

CHAPTER 6. Archeology of the Lower Midden Area 69
Randall L. Guendling

CHAPTER 7. Archeobotanical Remains from the 1990 Excavations at 3MR80-D Buffalo National River, Arkansas 87
Sandra L. Dunavan

CHAPTER 8. Zooarcheological Remains, Lower Midden Area 99
Susan L. Scott

CHAPTER 9. Artifact Analysis and Cultural Reconstructions for the Lower Midden Area 119
Randall L. Guendling

CHAPTER 10. The Dirst Site and Central Ozarks Prehistory 155
George Sabo III

REFERENCES CITED 165

APPENDICES 174

LIST OF FIGURES

1.1 Rush project study area, Buffalo National River, Arkansas. 2
1.2 Archeological sites in the Rush Development Area. 3
1.3 Excavations in the Dalton and Lower Midden Areas, 3MR80. 4
1.4 Schematic profile of the south wall of Backhoe Trench 1 through 3MR80-Area D 4
3.1 3MR80-Area D site map with 1990 excavation units. 14
4.1 Physiographic provinces of the south-central United States. 25
4.2 Buffalo River study area, physiographic plateaus, river segments and geologic study sites. 26
4.3 Stratigraphic column of north-central Arkansas. 27
4.5 Measurement of meander amplitude. 29
4.6 Longitudinal profiles of the Buffalo River and Little Buffalo River 30
4.7 Gradient of the Buffalo River and the Little Buffalo River. 30
4.8 Maximum valley relief for each segment of the Buffalo River. 32
4.9 Maximum bluff height for each segment of the Buffalo River. 32
4.10 Soil map and topographic cross section along a select area of the Buffalo River in segment 1. 33
4.11 Soil map and topographic cross section along a select area of the Buffalo River in segment 2. 34
4.12 Soil map and topographic cross section along a select area of the Buffalo River in segment 3. 35
4.13 Soil map and topographic cross section along a select area of the Buffalo River in segment 4. 36
4.14 Soil map and topographic cross section along a select area of the Buffalo River in segment 4. 37
4.15 Soil map and topographic cross section along a select area of the Buffalo River in segment 5. 38
4.16 Soil map and topographic cross section along a select area of the Buffalo River in segment 6. 39
4.17 Soil map and topographic cross section along a select area of the Buffalo River in segment 7. 40
4.18 Soil map and topographic cross section along a select area of the Buffalo River in segment 7. 41
4.19 Width of valley floor of the Buffalo River every 1.5 km distance downstream 42
4.20 Sinuosity of the Buffalo River at 1.5 km intervals. 42
4.21 Amplitude of meanders along the Buffalo River, from river kilometer 34 to the confluence with the White River 43
4.22 Wave length of meanders along the Buffalo River, from river kilometer 34 to the confluence with the White River 43
4.23 Plot of meander amplitude against meander wave length of the Buffalo River meanders. 44
4.24 Mean valley floor width for each segment of the Buffalo River 44
4.25 Mean sinuosity for each segment of the Buffalo River. 45
4.26 Width of the valley floor, the flood plain, and a low terrace of the Buffalo River at Boxley, Erbie, and Rush. 53
4.27 Thickness of overbank sediment that underlies the lowest terrace of the Buffalo River at Boxley, Erbie, and Rush. 54

LIST OF FIGURES CONTINUED

4.28 Age of abandonment of the lowest terrace and initiation of the modern flood plain of the Buffalo River at Boxley, Erbie, and Rush. 54
5.1 Excavation units in the Dalton Area. 58
5.2 Completed Dalton block excavations. 59
5.3 North wall N996/E997, Dalton Area. 59
5.4 Feature 12, plan and profile view. 61
5.5 Artifacts from Stratum 2a. 64
6.1 Excavation units, Lower Midden Area. 70
6.2 Completed North Block excavation, Lower Midden Area. 71
6.3 Completed South Block excavation, Lower Midden Area. 71
6.4 North wall profile, N994/E1026. 72
6.5 East wall profile, N994/E1030. 72
6.6 North wall and east wall profile, N996/E1028. 74
6.7 East wall profile, N990/E1030. 74
6.8 East wall profile, N988/E1030. 75
6.9 South wall profile, N988/E1026-1030. 75
6.10 Feature 10 plan and profile map. 77
6.11 Feature 11 N994/E1026 plan map, west profile map. 77
6.12 Feature 11. Top, unexcavated; Bottom, east half removed. 78
6.13 Feature 13 north profile map, N994/E1026 plan map. 79
6.14 Feature 14 plan map, west profile map. 80
6.15 Feature 14. Top, unexcavated; Bottom, west profile exposed. 81
6.16 Feature 15 N996/E1028 plan map, north profile map. 82
6.17 Feature 15. Top, half excavated; Bottom completely excavated 83
6.18 Feature distributions, Stratum 5. 85
8.1 Butchering marks on lateral malleolus of a wapiti and distal femur of a deer. 114
9.1 Artifacts from Strata 2 and 3. 122
9.2 Artifacts from Stratum 4. 127
9.3 Early Woodland Component, 3MR80-Area D. 132
9.4 Scallorn arrowpoints Stratum 5. 133
9.5 Rice Side Notched dart points, Stratum 5. 134
9.6 Woodland dart points. 135
9.7 Late Woodland/Mississippi Period arrowpoints, Stratum 5. 135
9.8 Curated dart points, Stratum 5. 136
9.9 Woodworking Tools, Stratum 5. 139
9.10 Flake Tools, Stratum 5. 140
9.11 Modified bone and shell items from features. 141
9.12 Lithics artifact from Feature 15. 141
9.13 Feature 14 Flake Tools. 142
9.14 Feature 14 Lithic Tools. 143
9.15 Selected Ceramics, Stratum 5. 147
9.16 Selected Ceramics, Stratum 5. 148
9.17 Ceramics, Features 14 and 15. 149
9.18 Rim profiles, Stratum 5 ceramics. 151
9.19 Initial midden development, 3MR80-Area D 151
9.20 Late Midden development, 3MR80-Area D. 152

LIST OF TABLES

2.1 Ozark prehistoric cultural sequences. 8
3.1 Artifact classification for 3MR80-Area D. 18
3.2 Attributes encoded for artifacts from 3MR80-Area D. 19
3.3 Classification for Chipped Stone Debitage. 20
5.1 Chipped Lithic Artifacts, Stratum 1b. 60
5.2 Chipped Lithic Artifacts by Raw Material, Stratum 1b. 61
5.3 Flakes by Weight and Raw Material, Stratum 1b. 62
5.4 Shatter by Weight and Raw Material, Stratum 1b. 62
5.5 Typed Projectile Points, Stratum 2a. 63
5.6 Chipped Lithic Artifacts, Stratum 2a. 65
5.7 Chipped Stone Artifacts with Cortex, Stratum 2a. 65
5.8 Heat Treated Tools, Stratum 2a. 66
5.9 Chipped Lithic Artifacts by Raw Material, Stratum 2a. 66
5.10 Flakes by Weight and Raw Material, Stratum 2a. 67
5.11 Shatter by Weight and Raw Material, Stratum 2a. 67
5.12 Chipped Stone Artifact Size Ranges. 68
6.1 Feature Data. 84
6.2 Results of 1990 Radiocarbon Dating Analysis. 86
7.1 Wood recovered from flotation samples from 1990 excavations at 3MR80. 88
7.2 Nut remains from flotation samples from 1990 excavations at 3MR80. 89
7.3 Nut weights and percentages from flotation samples from 3MR80 and conversions. 91
7.4 Seeds, cultigens, and other miscellaneous botanical remains recovered from flotation samples from 1990 excavations at 3MR80. 92/93
7.5 Seeds, cultigens, and miscellaneous botanical remains recovered from flotation samples from 1988 excavations at 3MR80. 94/95
7.6 Non-botanical remains from flotation samples from 1990 excavations at 3MR80. 96
8.1 Species list for faunal remains from 3MR80D. 100
8.2 Feature Data. 102-108
8.3 Overall Composition of 1988 and 1990 vertebrate Samples from 3MR80D. 109
8.4 Relative weight of deer and large mammal anatomical units from different kinds of Late Woodland deposits at 3MR80D. 110
8.5 Ubiquity for taxa identified in 1988 & 1990 Dirst Site Samples. 112
8.6 Estimated sizes of individual fish in Late Woodland period sample from Dirst site assemblage. 113
8.7 Minimum Number and Relative Frequency of Deer elements from 3MR80D Deposits. 115
8.8 Degree of Fragmentation of Deer and Large Mammal Skeletal Elements from Late Woodland Period deposits at 3MR80D. 116
8.9 Relative frequency of charred deer and large mammal elements from the Dirst site and the Summerville Village. 117
9.1 Projectile Point Chronology. 120
9.2 Typed Projectile Points, Premidden Strata. 120
9.3 Chipped Lithic Artifacts, Stratum 2. 120
9.4 Chipped Stone Artifacts by Raw Material, Stratum 2. 121
9.5 Flakes by Weight and Raw Material, Stratum 2. 121

LIST OF TABLES CONTINUED

9.6 Shatter by Weight and Raw Material, Stratum 2. 121
9.7 Chipped Lithic Artifacts, Stratum 3. 122
9.8 Chipped Stone Artifacts by Raw Material, Stratum 3. 123
9.9 Table of Tools with Cortex, Stratum 3. 123
9.10 Modified Flakes by Weight and Raw Material, Stratum 3. 124
9.11 Flakes by Weight and Raw Material, Stratum 3. 124
9.12 Shatter by Weight and Raw Material, Stratum 3. 125
9.13 Ceramics, Stratum 4. 127
9.14 Chipped Lithic Artifacts, Stratum 4. 128
9.15 Table of Tools with Cortex, Stratum 4. 129
9.16 Chipped Stone Artifacts by Raw Material, Stratum 4. 129
9.17 Modified Flakes by Weight and Raw Material, Stratum 4. 130
9.18 Flakes by Weight and Raw Material, Stratum 4. 131
9.19 Shatter by Weight and Raw Material, Stratum 4. 131
9.20 Typed Projectile Points, Stratum 5. 133
9.21 Chipped Lithic Artifacts, Stratum 5. 137
9.22 Ground Lithic Artifacts, Stratum 5. 138
9.23 Table of Tools with Cortex, Stratum 5. 138
9.24 Heat Treated Tools, Stratum 5. 142
9.25 Chipped Lithic Artifacts by Raw Material, Stratum 5. 144
9.26 Modified Flakes by Weight and Raw Material, Stratum 5. 145
9.27 Flakes by Weight and Raw Material, Stratum 5. 145
9.28 Shatter by Weight and Raw Material, Stratum 5. 146
9.29 Ceramics, Stratum 5. 146
9.30 Ceramic Distribution in Features, Stratum 5. 150
10.1 Cultural Components Identified in Area D at the Dirst Site 161

CHAPTER 1

Project Background

RANDALL L. GUENDLING

Introduction

This volume presents the results of a second season of investigations by the Arkansas Archeological Survey at the Dirst site, 3MR80, a deeply stratified, multicomponent archeological site located in the Rush Development Area of the Buffalo National River (Figure 1.1). The National Park Service (NPS) has proposed expanding public use facilities within the Rush Development Area, a 3.6 ha tract of land on the left descending bank of the Buffalo River that extends from Clabber Creek southwest to south of Rush Creek. Four archeological sites have been recorded within the area (Figure 1.2). In April of 1986, the Spears Professional Environmental and Archeological Research Service (SPEARS), under contract to the NPS, tested three of the four sites--3MR52, 3MR157, and 3MR80--to determine their significance (Spears et al. 1986). All three were found to contain significant subsurface deposits and were judged by SPEARS to be eligible for nomination to the National Register of Historic Places. The fourth site in the development area was previously recommended as eligible for nomination to the National Register (Sierzchula 1984).

Proposed expansion of the Rush campground will take place on the Dirst site, 3MR80, at the confluence of Rush Creek and the Buffalo River. New construction will have the most damaging effects on significant archeological resources at Area D of the site (Figure 1-2). In order to mitigate adverse impacts from this proposed construction, the NPS contracted with the Arkansas Archeological Survey (AAS) in 1988 for data recovery excavations in Area D. The goals of the 1988 excavations were: a) to explore the Area D landform to determine the vertical and horizontal distribution of cultural deposits, and b) to concentrate excavation on the most significant contexts in order to extract information to mitigate of the adverse impacts of proposed development.

Summary of the 1988 Investigations

The 1988 archeological and geomorphological investigations conducted at Area D of the Dirst site documented five prehistoric cultural components buried in a series of stratified alluvial sediments (Figure 1-3) (Guccione and Guendling 1990:77-106). These sediments form the overbank terrace deposits at the present confluence of Rush Creek and Buffalo River. Backhoe trenching and hand excavations on the first and second terraces allowed the simultaneous study of both the history and relative rate of sedimentation and the nature and sequence of human occupation in each stratum (Sabo et al. 1990). These investigations identified significant near surface archeological deposits distributed in three discrete areas within the larger site area. These are the Upper Midden Area on the Terrace 2 (upper), a projected Dalton Area on the slope between the two terraces and a Lower Midden Area on the Terrace 1 lower) (Figure 1-4). Excavations centered on the latter two areas.

The earliest stratum uncovered (Stratum 1a, Figure 1-4) in deep trenching was a Pleistocene age lag gravel deposit that forms the core of the lower terrace. This deposit lay directly over bedrock and contained no evidence of human occupation. The earliest human occupation was found in Stratum 1b

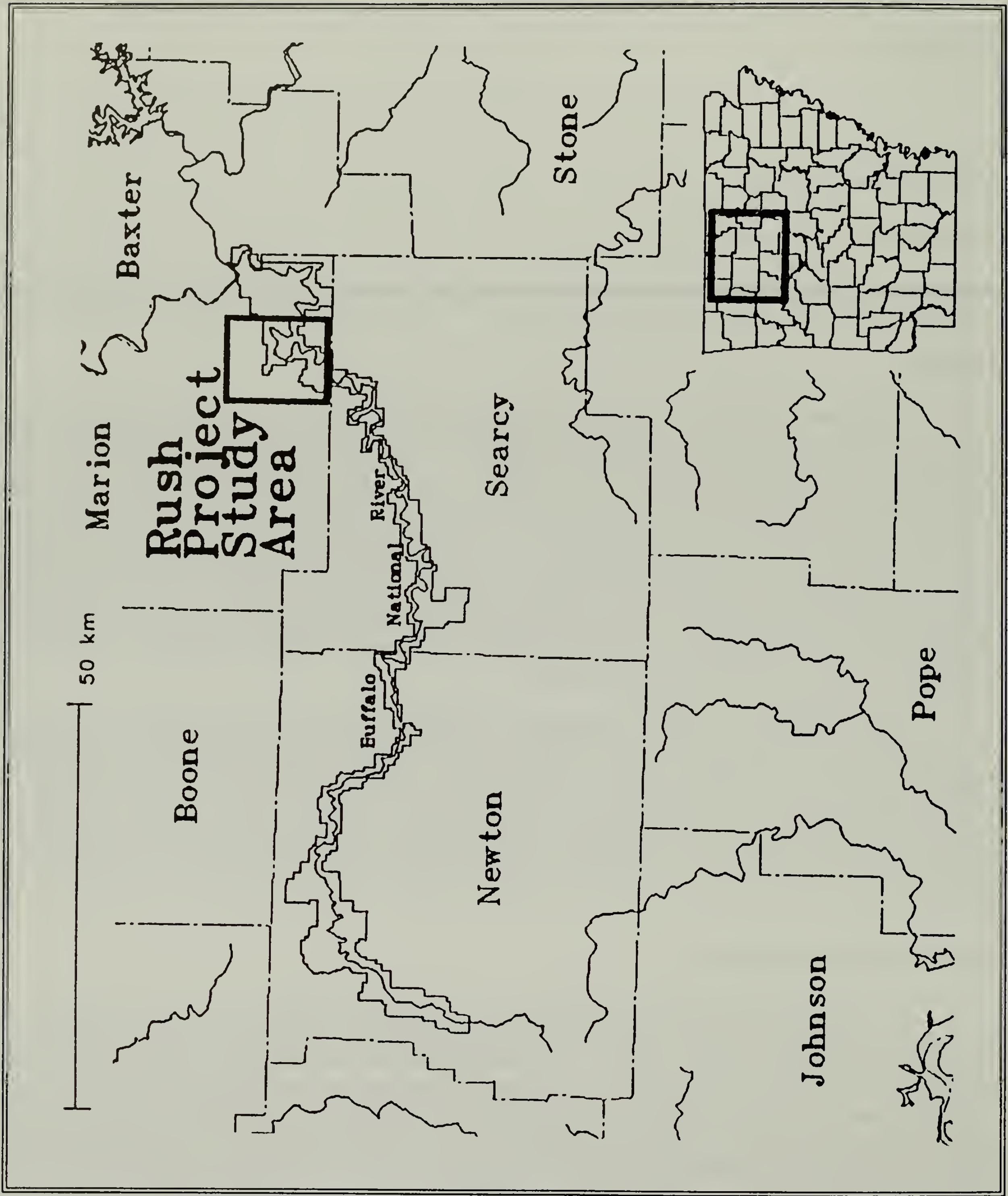

Figure 1.1 Rush project study area, Buffalo National River, Arkansas

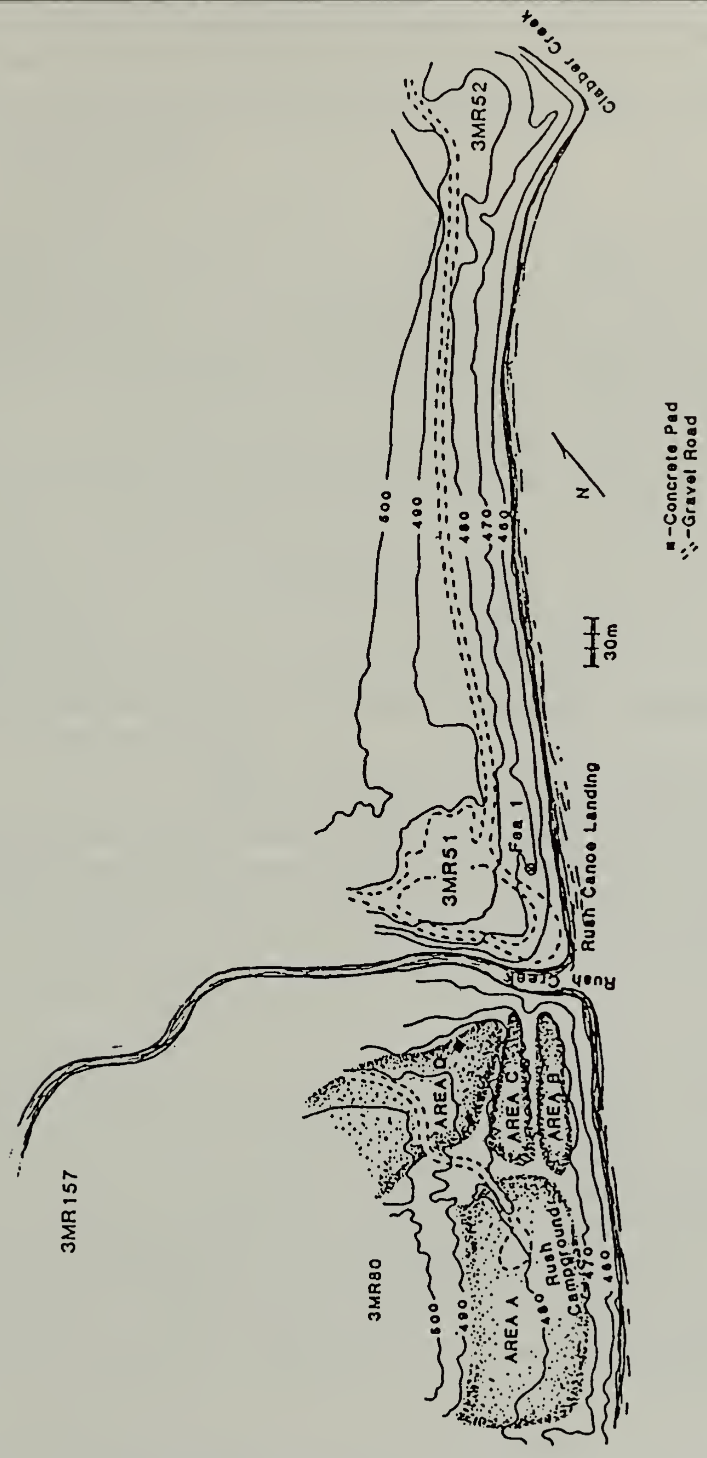

Figure 1.2 Archeological sites in the Rush Development Area.

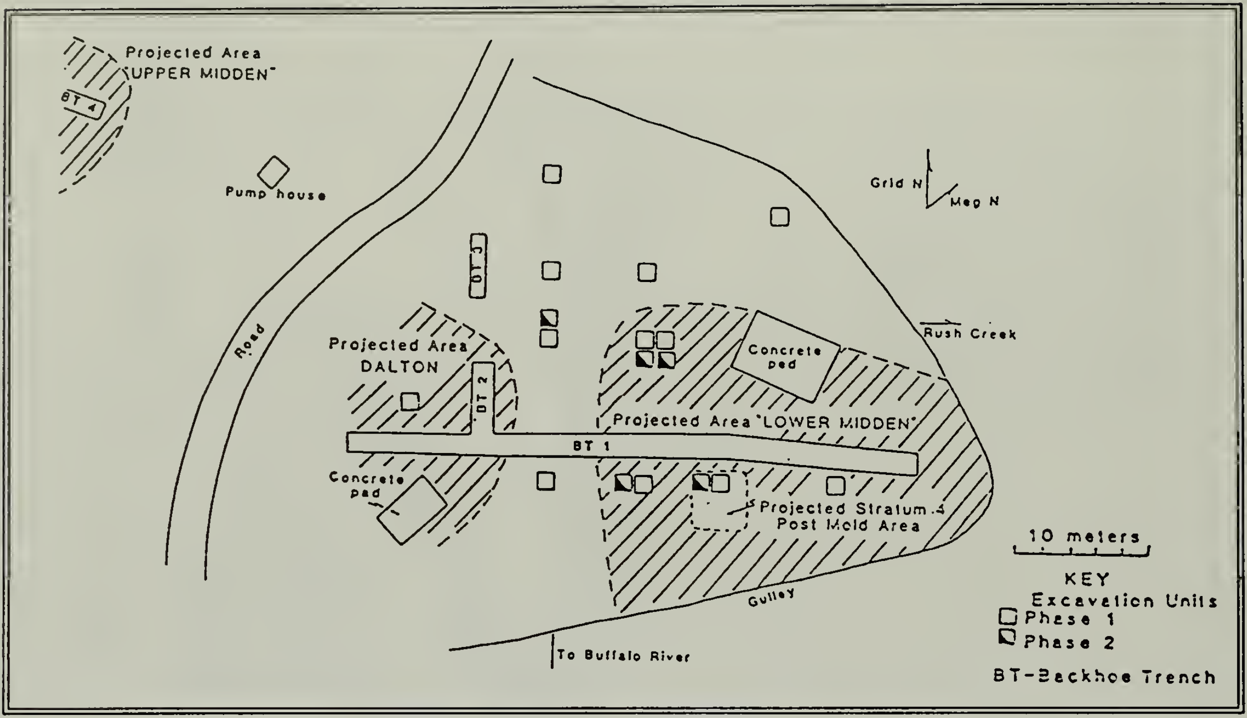

Figure 1.3 1988 Excavations in the Dalton and Lower Midden Areas, 3MR80.

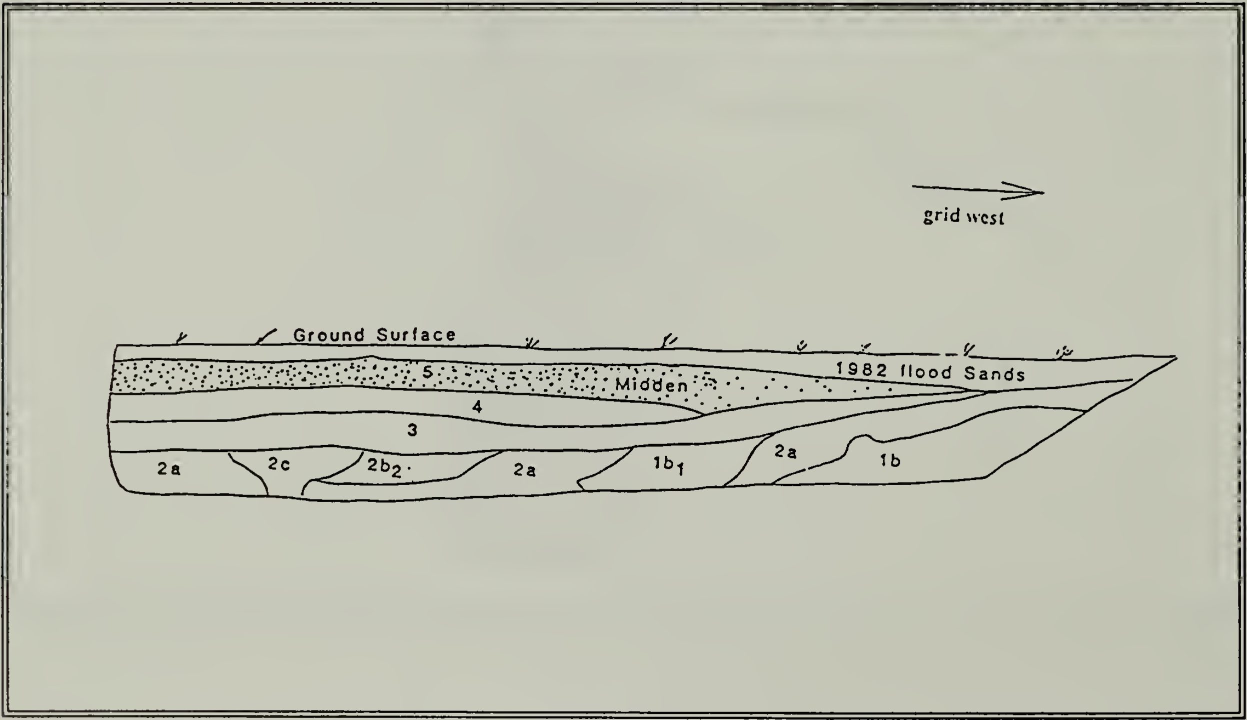

Figure 1.4 Schematic profile of the south wall of Backhoe Trench 1 through 3MR80-Area D (Sabo et al. 1990:Figure 2-2).

deposited on the 1a gravels. This stratum was recognized as a paleosol that produced artifacts during the trenching that date to the Dalton and Early Archaic periods. Stratum 1b was exposed along the slope between the first and second terraces where it is within 50 cm of the surface. It presumably underlies the Lower Midden Area on the first terrace below the reach of the backhoe or hand excavated units. Additional fragmentary Dalton points were found in Stratum 1b in one excavation unit on the terrace slope (Figure 1-4) in the portion of the site subsequently called the Dalton Area.

Stratum 2 overlay Stratum 1b on the terrace slope in the Dalton Area and was identified along the full length of the backhoe trench through the Lower Midden Area on the first terrace. This single massive stratum contained some angular sandstone, chert flakes and waterworn rock. Toward the east end (toward Rush Creek) the stratum is broken by a series of cut and filled chute channels (2b, 2c). The 2a sediments were interpreted as Early Holocene age deposits based upon Early and Middle Archaic projectile points found during trenching. Only two excavation units reached this stratum and neither uncovered temporally diagnostic artifacts.

A series of three Late Holocene strata which lay conformably over Stratum 2 (Figure 1-3) contained evidence for increasing human use of the Dirst site through time. The strata were confined to the south side of the low terrace and were all contained within the boundary of the Lower Midden Area.

A Late Archaic component was identified in Stratum 3. This occupation was evidently a short term, probably seasonal, utilization of the low terrace that produced neither features nor midden development. The excavations allowed the reconstruction of stoneworking technology, though the three test units that reached this stratum found very poor preservation of floral and faunal material. A similar but separate component was identified in the trenching on the high terrace. This restricted deposit also produced Late Archaic projectile points and was termed the Upper Midden Area.

Stratum 4 was defined as a thin, organically enriched midden sediment that contained temporally diagnostic projectile points and grog-tempered pottery. The projectile points were similar to types from Stratum 3 identified as Late Archaic, however the in situ discovery of grog-tempered pottery strongly indicated an unprecedented Early Woodland component. Seven excavation units reached this stratum and an arc of postmolds was exposed in two contiguous units. Bone preservation was poor, but carbonized remains from the midden and the presence of a possible structure indicated a change from a mobile to a semi-sedentary adaptation at the Dirst site during this time period (Sabo et al. 1990:18-19,279-283).

The uppermost prehistoric cultural occupation was a thick, organic laden midden sediment designated Stratum 5. The midden contained abundant cultural debris which included grog and shell-tempered pottery, lithic tools and debitage, animal bones and mussel shells, and carbonized plant remains. Prehistoric pits, postmolds and a recognizable living surface were cultural features defined within the midden stratum. The artifact assemblage and associated radiocarbon dates suggested the midden was deposited between the Middle Woodland to Early Mississippi periods. One highly important, though puzzling, association was the presence in one pit feature of shell-tempered pottery, Woodland period style projectile points and carbonized plant remains including maize. The radiocarbon dates from this feature fell in the Middle Woodland period, indicating an unusual association of artifacts in a sealed context. The impression gained from the nine excavation units in Stratum 5 was that the transition from a semi-sedentary to a sedentary type of adaptation may have begun in the Middle Woodland period, earlier than thought by most archeologists (Sabo et al. 1990:19-20,279-283).

AAS and NPS agreed that the stratigraphic record at the Dirst site was unique and extraordinarily significant for the Central Ozark region and that further excavations were necessary to mitigate the impacts of development. Consequently, a new subagreement was added to the existing cooperative agreement for additional investigations.

The significant deposits at Dirst site, though they represent an unprecedented discovery in the Ozarks, are not isolated at the Rush Creek locality. In order to provide protection for the four interrelated prehistoric sites at the Rush Development Area NPS also asked that a comprehensive archeological management plan be devised for the use of the Area. It was also recognized that the integration of the geomorphological and archeological analyses provided a three dimensional context for understanding the formation of the cultural deposits. The geomorphological analysis was to be expanded in the 1990 investigations to encompass a river wide model for the deposition of sediments along the Buffalo River. Such a model would have both interpretive and predictive value for evaluating buried cultural deposits.

CHAPTER 2

1990 Project Objectives

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This chapter presents a brief synopsis of regional cultural history, regional research goals and the theoretical background of the project. The specific goals of the 1990 work are then presented. A full discussion of the regional background and the theoretical perspectives guiding both phases of the project are presented in Sabo et al. (1990:13-23).

Regional Culture History

Since the publication of James B. Griffin's synthesis of eastern North American prehistory in 1967, his four conceptual stages of cultural evolution have come to dominate thinking in American archeology. Briefly stated these four stages begin with the Paleo-Indian stage referring to the earliest documented nomadic hunting and gathering human groups colonizing America at the end of the Pleistocene. The ensuing Archaic stage was denoted by steadily increasing populations, hunting and foraging economies, and the rise of regionally distinct cultures. The following Woodland stage was differentiated by the invention of pottery vessels, plant domestication, and increasing social complexity. The last prehistoric stage, termed Mississippian, was seen as a cultural flouresence of complex ranked societies dependent on maize agriculture, whose religious beliefs are enshrined in surviving examples of temple mounds and a rich artistic expression.

While Griffin's conceptual stages were quickly applied throughout eastern North America, the Ozarks were viewed as an exceptional case of culturally retarded development. Largely as a result of Mark R. Harrington's (1924, 1960) interpretations of bluff shelter excavations, the concept of the Ozark bluff dweller culture saw the Ozark Mountains as somehow frozen at an Archaic hunting and foraging stage. Ironically, the evidence refuting this concept was collected simultaneously with the data Harrington interpreted as supporting his thesis of Ozark marginality.

The last decade has finally seen the myth of an Ozark cultural backwater largely dismantled by a reexamination of the original data (Brown 1984a) and new fieldwork (Sabo 1986, Kay 1986). The Ozarks are no longer seen as an isolated region, but fully integrated and interacting with nearby cultures bordering the Ozarks.

Regional Research Goals

With the reintegration of the Ozark region into the cultural trends evident elsewhere in eastern North America, it has been recognized that Griffin's concept of evolutionary stages is a unilineal one. This concept is at odds with a mounting body of evidence for multilineal regional change that seems to be dependent on local environmental circumstances as well as independent cultural variation. This apparent impasse has been avoided by many scholars by retention of Griffin's four stages as time periods (Table 2.1) rather than stages of development. In the Ozarks region an alternative conceptual model using adaptation types to assess cultural evolutionary trends has been successfully applied (Sabo 1988).

Table 2.1 Ozark prehistoric cultural sequences (after Sabo et al. 1988:34)

Mississippi		300-1,100 B.P.*
Woodland	Sedentary Cultivators	
Late		1,100-1,350 B.P.
Middle		1,350-1,800 B.P.
Early		1,800-2,500 B.P.
	Semi-Sedentary Cultivators	
Archaic		
Late		2,500-5,000 B.P.
Middle		5,000-8,000 B.P.
Early	Foragers	
Dalton		9,500-10,500 B.P.
	Hunters	
Paleo-Indian		10,500-12,000 B.P.

* B.P. refers to years before present

The adaptation type (Fitzhugh 1975) is a non temporal generalizing construct which focuses on "the interrelationships between human socioeconomic activities and their environmental contexts" (Sabo 1990:15). The temporal dimension is provided by artifact seriation and/or direct chronometric measurement independent of adaptation type. A specific adaptation type has no necessary temporal placement, nor does one adaptation type necessarily precede or follow another one. Adaptive types are also free of the trait list syndrome -- the association of certain type artifacts with specific cultural stages. Thus the appearance of shell-tempering at an early date is seen as regional technological innovation accompanying changes in adaptive strategies rather than an abberation in the "wrong" cultural stage.

Four adaptive type models, developed by Sabo (1988) specifically for the cultures documented in the Ozark Mountain Region were used as the framework for a comparative analysis of the results of the investigations at Dirst site. Hunters, Foragers, Semi-sedentary Cultivators and Sedentary Cultivators (Sabo 1990:16-20) are economic adaptions to environmental conditions documented in the Ozarks region (Table 2.1). Viewed in the context of adaptation types the research conducted in 1990 centered on gathering information to further define and investigate the transitions from Hunters to Foragers in Dalton Area and from Semi-sedentary to Sedentary Cultivators in the Lower Midden Area of 3MR80-Area D.

Theoretical Perspective

The theoretical perspective underlying the research at Dirst site is embodied in human ecology (see Butzer 1982). The guiding assumption is that neither environment nor culture are primary factors in the organization and evolution of human ecosystems. It is the interaction of these two factors that must always be assessed in the context of a specific case. In this sense the adaptation type discussed above can be seen as operationalizing the theoretical approach. A human ecology approach to archeological data assumes a multidisciplinary study of past human ecosystems including, but not limited to, geoarcheology, paleobotony, zooarcheology, and bioarcheology.

The study of the environmental parameters in the Dirst locality (Limp and Smith 1990:25-60; Limp 1990:285-318) described area rich in plant and animal resources as well as raw materials such as chert. However, these resources were not evenly distributed in the environment. The narrow, deeply incised Buffalo River Valley (ca 229 m below the surrounding uplands) restricted access to resources differentially distributed between the upland and lowland environments. Consequently, the Dirst site location appears to be situated to access multiple resource zones. While the environmental context of the Dirst Site was thoroughly evaluated in 1988, it was determined that additional investigations were required to better understand the archeological record at the site and to develop a geoarcheological model for the entire Rush Development Area.

1990 Project Objectives

The 1990 project objectives, developed on the basis of negotiations between AAS and NPS, were outlined in a scope of work and a written proposal (Appendix A). In brief, the 1990 objectives were:

1) To conduct additional archeological investigations at 3MR80 to mitigate adverse impacts to known archeological resources stemming from proposed expansion of the campground facilities.

2) To conduct additional archeological investigations at selected locations along the north bank of the Buffalo National River between Rush Creek and Clabber Creek to fill in existing gaps in our understanding of the geomorphology and archeological record of the Rush Development Area as a whole.

3) To develop an Archeological Management Plan for the entire Rush Development Area, based on 1) and 2) above plus consideration of all previous archeological work and documentary research concerning the Rush locality.

Data Gaps in the 1988 Investigations at 3MR80-Area D

Archeological tests conducted in four areas (Figure 1-2, Areas A - D) at 3MR80 (Spears et al. 1986) identified buried, near-surface, midden deposits in Area A and Area D judged to be of considerable scientific importance. Investigations in Area D conducted by the Arkansas Archeological Survey in 1988 sampled the midden deposit as well as several more deeply buried deposits. NPS plans for expansion of the present campground facilities poses the greatest danger of adverse impacts to significant archeological deposits in Area D that occur at depths of 50 cm below the present ground surface or less. A very limited range of proposed construction activities would potentially cause disturbances at greater depths, and these are best considered on an individual basis. Identified below are specific areas of concern based on previous work at 3MR80.

The Lower Midden Area Stratum 5 midden (Figure 1-3) contained archeological deposits representing occupations from Middle Woodland to Early Mississippi times. Excavations to the base of this midden revealed a compacted living surface and one large, refuse-filled pit originating at this surface was excavated. There was, additionally, some evidence observed in the midden excavations from 40 - 60 cm in depth for a structure of undetermined function. It was not possible to delineate this suspected feature during the 1988 excavations. Abundant and well-preserved faunal remains provided important information concerning prehistoric subsistence parameters for the midden occupation. Paleoethnobotanical sampling of the midden included the recovery of maize in a context apparently predating AD 800.

Immediately below the Stratum 5 midden, in a Late Archaic or Early Woodland occupation level (Stratum 4), a partial arc of postmolds was discovered at an approximate depth of 50 cm. It was not possible at the time of its discovery to expose this feature fully.

The final discovery in Area D of concern to present objectives was the identification of a buried paleosol (Stratum 1b) containing Dalton and Early Archaic period artifacts. In the Dalton Area, just east of the campground access road, this paleosol occurs at a depth of only about 50 cm below the present ground surface and is particularly susceptible to damage.

Another large midden deposit was defined on 3MR80 by SPEARS (1986) in Area A. The artifact content of this midden indicated a Woodland to Mississippi period occupation. In the absence of additional excavations, the extent, and to a lesser degree the content of this midden was incompletely understood. Nor did we understand the occupational relationship between this midden and the midden deposit in Area D.

In order to investigate these data gaps, specific objectives of the 1990 work were as follows:

1) Backhoe stripping to 40 cm in the Dalton Area where the buried paleosol occurs at an approximate depth of 50 cm. Hand excavation of a 4 x 4 m unit to the depth of the paleosol, with flotation sampling and screening of all excavated sediments.

2) Hand excavation of a 4 x 4 m unit in the Lower Midden Area where the Late Archaic/Early Woodland arc of post molds was discovered in Stratum 4 to more fully expose this feature. Both overlying midden and Stratum 4 sediments to be excavated with flotation sampling and screening of all deposits.

3) Hand excavation of a 4 x 4 m unit in the Stratum 5 midden where the presence of a structural feature at 40 - 60 cm depth is suspected. Flotation sampling and screening as above.

4) Systematic auger testing of Area A to determine extent of the midden deposit.

5) Excavation of two to four 2 x 2 m test units, if deemed necessary, in the Area A midden deposit based upon the results of the auger testing. The two phase excavation strategy employed in the 1988 excavation to be employed to expand excavations at the base of the midden in any units containing features.

Investigations Between Rush Creek and Clabber Creek

Previous investigations at 3MR51, on the east side of Rush Creek, and at 3MR52, on the west side of Clabber Creek (Figure 1.2), have documented buried archeological deposits at these two locations. The subsurface deposits at only one of the sites, 3MR52, have been documented by a geomorphologist (Dixon 1986). Direct correlation of those strata with 3MR80 is not possible due to the distance between the sites. Furthermore, no subsurface investigations had been undertaken in the area between the archeological sites on Rush and Clabber Creeks. There was potential for buried prehistoric deposits in the intercreek area, as well as archeological evidence of the late 19th - early 20th century White Eagle mine operations. Further limited testing for near surface archeological deposits along the north side of the Buffalo National River between Rush Creek and Clabber Creek was therefore recommended. The testing was considered a necessary prerequisite for the development of a comprehensive Archeological Management Plan for the entire Rush Development Area. The following specific investigations were recommended:

1) Intensive surface examination and systematic auger testing in the area between the mapped boundaries of 3MR51 and 3MR52 to identify archeological materials in surface as well as buried contexts.

2) Additional test excavations and/or backhoe trenching as necessary to document the geomorphological context of any buried archeological deposits that might be discovered in step 1) above.

Archeological Management Plan

Four archeological investigations have been undertaken within the Rush Development Area since 1979 (Bradford 1979; Sierzchula 1984; Spears et al. 1986; Sabo et al. 1990). The cumulative results are a finding that all four prehistoric sites in the Development Area contain significant archeological deposits. The deposits at the four sites also lie buried in stratified sediments and are discontinuous within sites as well as between sites. While these conclusions can be easily stated in this forum, the site data is dispersed in several sources. Furthermore, the context and interrelationships of these cultural resources has either not been synthesized or the data to do so is as yet unknown.

The NPS has the primary responsibility for managing and protecting the integrity of cultural resources in the Buffalo National River while at the same time developing use areas for the public. In order to efficiently and effectively manage the cultural resources in the Rush Development Area the data from all previous research need to be summarized in a single source. The information can then be used to determine likely effects of public use and development on significant cultural resources. Since cultural resources are highly correlated with landforms, expansion of the geomorphological study successfully applied at Dirst site and others (Dixon 1986; Guccione 1988, 1989a, 1989b; and Guccione and Guendling 1990) is critical to predicting the depths and distributions of buried deposits.

Therefore, the third general objective is to develop an Archeological Management Plan for the entire Rush Development Area. The plan is to utilize information acquired as a result of the proposed 1990 .pa investigations described above, all previous archeological work and previous documentary research concerning the Rush locality. Specific elements of the Archeological Management Plan included:

a) synthesis of all extant data concerning the geomorphology and archeological structure, content, condition, and quality of evidence for the Rush Development Area, including a summarization of current interpretations concerning the prehistoric and historic occupations of the Rush locality.

b) development of a geoarcheological model to characterize the known and predicted locations of all archeological deposits within the present landforms of the Rush Development Area.

c) delineation of all areas where specified public use and facilities expansion activities should or should not be permitted, in addition to other recommendations, in line with NPS cultural resource management objectives to preserve the integrity of significant archeological deposits within the Rush Development Area.

To achieve and expand these basic objectives, the AAS provided the following to complement the cultural resource management goals of this project:

Personnel. Dr. Charles R. Ewen, Administrator of the AAS Sponsored Research Program, served as the Principal Investigator for the 1990 project season reported here. A portion of Dr. Ewen's time both during the fieldwork and analysis stages was contributed to the project by the AAS.

Dr. George Sabo III, Station Archeologist for the AAS whose research concentrates on the study of the Ozark Mountain archeological region (Sabo 1986; Sabo et al. 1982; Sabo et al. 1988), served as a consultant throughout this project. All his time was contributed to the project by the AAS.

Public Outreach. The AAS anticipated considerable public interest in the work at the Rush Development Area based on the 1988 public outreach success. Public interest was accommodated in three ways. First, during the course of the excavations, two designated crew members gave guided tours to visitors. Visitors were given brochures describing the prehistory of the area, the history of the site, conclusions drawn from the first phase of mitigation and the source of project funding; they were also shown artifacts which were kept at the site for display purposes. Some 353 individuals signed in at the site and were given escorted tours, while the Principal Investigator and Project Archeologist gave on-site lectures to a total of 420 school children and 37 adult chaperones from school sponsored field trips. Second, project archeologists were available for interviews that appeared in several local and regional newspapers and for videotaped programs that appeared on the local Public Access Television Channel. Third, responding to another invitation from the AAS, members of the Arkansas Archeological Society volunteered some 625 hours of excavation time to the project. Volunteer fieldwork was organized as part of a comprehensive training program that has been jointly sponsored and conducted by the Survey and Society for over twenty years. As a result of these three program elements, the Rush project was a tremendous success in public outreach for the NPS, exceeding the highly successful public outreach effort achieved in 1988.

Computer Applications. The third AAS contribution to the Rush project derives from the Survey's ongoing development of computer applications in archeological research. The AAS is nationally recognized for its computer facilities and its applications of database management and Geographic Information Systems (GIS). Several computer applications were incorporated into the 1990 Rush project.

DELOS, developed by the AAS over the last decade, is a robust database management system for artifact information storage, manipulation and retrieval. The DELOS system was employed in both the preliminary cataloging and analysis phases of the Rush project. The DELOS system is compatible with the NPS Automated National Cataloging System (ANCS). In a separate subagreement, AAS wrote software to convert DELOS data into an ANCS format for required federal forms. A pilot DELOS-to-ANCS conversion was performed using the first Rush project and the 1990 collections were documented for NPS using the DELOS-to-ANCS conversion.

Another innovation employed by the AAS for the 1990 project is the use of a bar code reader to facilitate data entry into DELOS. The software program allows the creation of bar codes for all DELOS categories that can be read with a light pen. For example, strings of repetitive numbers, such as the site number and the first part of the accession number can be rapidly encoded. A proficient operator can enter roughly 30-40 % more records per hour than on a keyboard, and typographic errors are eliminated. Overall, record editing time is significantly decreased.

CHAPTER 3

Field and Laboratory Methods

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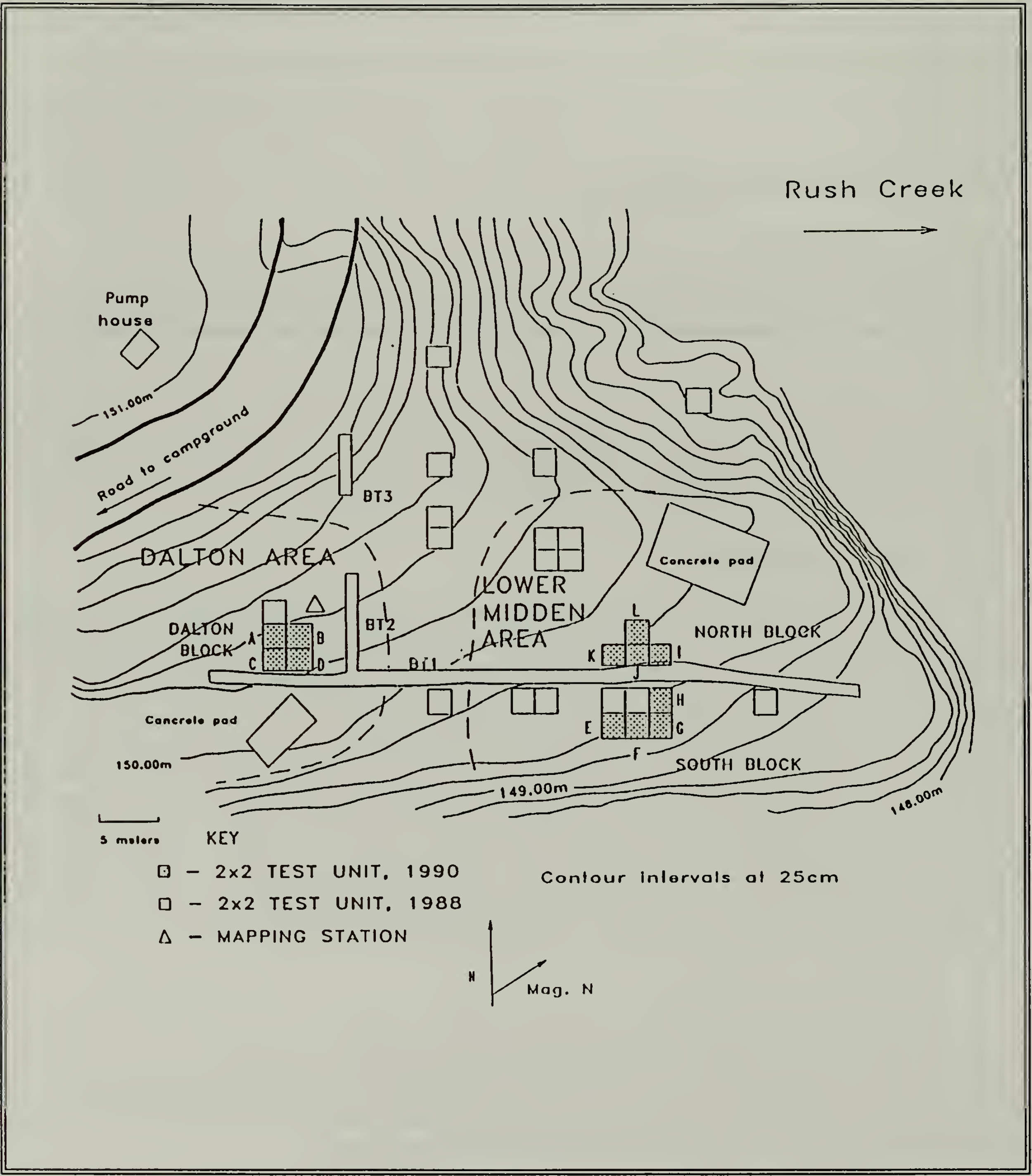
This chapter describes the field and laboratory methods employed during the 1990 investigations at the Rush Development Area. The major effort of these investigations centered on the data recovery excavations in the near surface deposits (the Lower Midden and Dalton areas) of 3MR80-Area D. The auger testing of 3MR80-Area A and the intercreek testing between Rush and Clabber Creeks were conducted for the purpose of developing a broader understanding of the geoarcheology of the entire Rush Development Area.

Excavation Methods at 3MR80-Area D

Fieldwork was initiated at 3MR80-Area D by reestablishing the 1988 grid system and keying all new units off the base lines (Figure 3-1). Excavation units were placed in the two areas targeted for additional data recovery; the Dalton area just east of the campground road and the lower midden area on the lower portion of the terrace. All excavation units on the site were dug in 10 cm levels within culturally defined zones and the sediments were dry screened through 6 mm mesh. Each level excavated also had a 50 cm x 50 cm x 10 cm flotation sample taken and processed on site through a water flotation system. All excavated feature fill was also processed through the flotation system. In units where a living surface could be identified, the excavation level was adjusted to a 5 cm cut taken in 16 separate 50 cm squares. Two of the 16 proveniences were removed as flotation samples in each of these 2 x 2 m units. Provenience control was maintained by assigning a Field Serial Number (FSN) to each sample unit (whether an individual artifact, feature, other subunit or complete excavation unit level) . This FSN was recorded in the master catalog and written on all corresponding inside and outside bag tags. Excavation unit level sheets containing notes, FSN's, plan drawings and other information were filled out by individual excavators as levels were removed. Additional site notes were taken by both Ewen and Guendling. Profile drawings, unit level and general photographs and feature forms were completed as appropriate.

The Dalton area was investigated by first reopening the 1988 test unit to expose the profile mapped during the earlier excavations (Figure 3.1). A 4 m x 4 m block was then staked south of the 1988 unit and stripped of 20-30 cm of overburden to just above the projected elevation of the Stratum 1b sediments containing the Dalton horizon. A backhoe and front end loader provided by NPS was used for the stripping operation. The heavy equipment was also used to reopen a segment of Backhoe Trench One parallel to the south side of the larger 4 m x 4 m block to expose a meter deep vertical profile for reference purposes.

Four 2 m x 2 m units were staked within the 4 m block. Two of the four units were excavated into the 1b sediments while the other two units remained within the overlying Stratum 2a levels at the end of the fieldwork. Features of prehistoric origin were neither expected nor found in this stratum. The assemblage derived from Stratum 1b in 1988 consisted of both Dalton and Early Archaic period projectile points. Artifacts collected from this stratum in 1990 are predominately Early to Middle Archaic forms. No recognizable Dalton period artifacts were recovered which suggests a very ephemeral use of the site by Dalton peoples.



A	N996/E995	E	N988/E1026	I	N994/E1030
B	N996/E997	F	N988/1028	J	N994/E1028
C	N994/E995	G	N988/E1030	K	N994/E1026
D	N994/E997	H	N990/E1030	L	N996/E1028

Figure 3.1 3MR80 - Area D site map with 1990 excavation units.

The lower midden area of 3MR80-Area D was the focus of the major excavation effort in 1990. In order to relocate the arc of postmolds in Stratum 4 the two backfilled units N990/E1026 and N990/E1028 were reopened by hand excavation. The unit floor had been covered with plastic sheeting in 1988 and was easily relocated. The section of Backhoe Trench One paralleling these units was also reopened by hand to provide a reference profile and teaching aid for visitors. Both units and the trench were reexcavated to approximately 60 cm below surface.

Four excavation units, each 2 m x 2 m , were staked on the south side of Backhoe Trench One south and east of N990/E1026-E1028 to intersect the projected complete arc of postmolds in Stratum 4. On the north side of the backhoe trench immediately opposite the south block, a block of six 2 m x 2 m units was staked to intersect the projected prehistoric structure in Stratum 5 (Figure 3.1). The north block was centered on the large postmold mapped in the south wall profile of the trench in 1988. All four units in the south block were excavated through the midden stratum into Stratum 4. Four of the north block units were excavated through the midden Stratum 5 into Stratum 4 approximately 60 cm below the surface. One of the north block units was excavated through Stratum 4, Stratum 3 and into the top of Stratum 2a approximately one meter below the surface.

Flotation Sample Processing

Flotation samples, taken from standard proveniences in each block excavation as described above, were assigned two FSN's, one for heavy fraction and one for light fraction. Provenience control was maintained by writing the sample FSN on a piece of flagging tape in indelible ink. The tape was then weighted with a large metal washer to assure it stayed with the sample through the water proccessing. Heavy fraction samples were caught on window screen (16 mm) in the flotation tanks and were transferred to open screen trays of the same size for drying. The fine fractions were caught in 4 mm mesh bags that were tied closed at the end of the sample run and dried on the site. The dried heavy fractions were placed in an artifact bag and inside and outside bag tags were filled out for each provenience. Light fractions were tagged with outside tags only for transportation to the laboratory.

Excavation Methods at 3MR80-Area A and the Intercreek Area

Excavations at 3MR80-Area A and the Intercreek Area were undertaken to explore the upper surface in both locations. The testing consisted of power augering soil columns along baselines placed on each site. On Area A a grid was flagged with transects 10 m apart and individual auger holes placed at 10 m intervals on each transect. Seven transects totaling 49 auger holes were examined on Area A. In the Intercreek Area, a single baseline following a cleared powerline was flagged between the mapped site limits of 3MR51 and 3MR52. Fourteen auger tests were placed at 20 m intervals along the baseline. An additional four auger tests were placed on 3MR52 and three tests were placed on 3MR51 extending the baseline onto the site limits. The Intercreek Area testing was completed with a series of five auger tests along the canoe access road parallel to the Buffalo River.

A two person hand operated gasoline power auger and a tractor mounted power auger with a 25.4 cm bit were used for test excavations. Auger tests varied between 60-90 cm deep depending on the nature of the soil. Area A auger tests were generally deeper due to the sandy soils, whereas roadways and mine tailings in the Intercreek Area were more difficult to penetrate. Initially soil from the auger tests was screened through 64 mm mesh, however it was found to be just as thorough and more efficient to hand sort the soils using a trowel. All artifacts were bagged by provenience and notes were taken recording depth, soil matrix and contents of each auger test.

Laboratory Processing Procedures

Provenience control was maintained throughout the laboratory processing by use of FSN's (See Appendix 3). The finished artifact bags were checked against the field specimen catalog in the field so that omissions or errors could be corrected before the bags were sent to the lab. Upon arrival at the central laboratory in Fayetteville, bag tags were double-checked against the field specimen catalog and all remaining errors were resolved prior to further processing.

Initial processing procedures consisted of emptying the contents of each bag onto a washing tray lined with window screen. Charcoal and other delicate materials were placed in vials or plastic zip-lock bags with a tag containing the FSN number. Lithic debitage, ceramics and bone were cleaned by light finger-scrubbing under water. Ground stone and chipped stone tools and other non-flake or unmodified lithic materials were cleaned by scrubbing with soft-bristle toothbrushes.

After washing, the materials associated with each FSN were sorted by lab workers into the following categories: chipped stone artifacts, ground stone artifacts, flakes and shatter, fire-cracked rock, other broken rock, unmodified rock, ceramics, bone, shell, charcoal, historic artifacts, and "other." The historic component was represented by very few artifacts. All but one artifact, an aluminum token marked "5 cents", could be attributed to the camping facility operated on the site during the late 1960s and early 1970s by the late Fred Dirst. Since the Fred Dirst occupation is not archeologically significant (Sabo et al. 1990:68), these artifacts were packaged for permanent storage and not included in subsequent analysis. The 5 cent token, while associated with a historically significant period of the Rush locality, has no intrinsic archeological significance in the absence of historic features on Area D from the same period. The historic artifacts collected and their proveniences are indicated in the artifact appendices.

Flotation samples were handled separately from the other collections. Light fractions were thoroughly dried, if still damp, and transferred to aluminum envelopes. The numbered flagging tape was retained with the sample and the provenience written on the outside in indelible ink. Unanalyzed light fractions were placed in plastic bags for storage. Heavy fractions were also thoroughly dried and were then transferred to plastic bags and placed in individual boxes for storage unsorted if unanalyzed. Analysis samples were shipped to specialists for further processing or curated at this step.

Additional processing and analysis of the collections were conducted under the protocols established for the 1988 project. All chipped lithic materials were separated into the following categories: worked pieces, either whole or fragments, cores, and flakes and shatter. Unmodified raw material was sorted into fire-cracked rock, other broken rock and other unmodified rock. Cores, flakes and shatter were size graded using screens of 5.08 cm, 3.81 cm, 2.54 cm, 1.27 cm and 0.64 cm mesh. These materials were then sorted by raw material type, weighed, counted and placed in labeled zip-lock plastic bags. Unmodified raw material were also size graded, sorted by raw material type, and weighed. However, only unmodified raw material and fire cracked rock from features and from living floors were retained for curation. Other raw material and fire cracked rock were discarded after recording. All other artifact categories such as worked tools, ground stone tools, ceramics, bone, shell, etc. were individually bagged by category for later analysis.

Collections were then organized in major analytical groups: bone, flakes, unmodified raw material, lithic tools, ceramics, ground stone tools, and flotation samples consisting of light fractions and heavy fractions. Each group was boxed in FSN order. The state accession number and individual FSNs were written in indelible ink on all chipped and ground stone artifacts, unmodified raw material, flakes, and chipping debris if the size grades were greater than 1.27 cm. A tag containing both the state accession number and the NPS accession and catalog number was also placed in each artifact bag. The outside of the bag was labeled with full state and NPS accession numbers. All artifact bags from a single provenience unit were placed in a single cardboard interior box. Interior boxes were placed according to FSN in heavier, covered exterior boxes labeled as to their contents.

Classification and Analysis

The entire 1990 collection of processed materials was examined by the Project Archeologist and preliminary sorting errors were corrected. All tools other than flakes and unmodified raw materials were pulled and subjected to more detailed classification to provide the necessary data sets for a number of specific analyses. The classification used was identical to that used in the 1988 analysis. Guendling worked closely with Sabo during the artifact sorting to ensure comparability between the 1988 and 1990 data sets.

The Arkansas Archeological Survey's DELOS computerized artifact classification system was employed for database management purposes. As artifacts from the Lower Midden and Dalton Areas were classified, inventory data were recorded onto DELOS coding forms and entered into a data base maintained on a current 6300 computer. All data base manipulations and production of summary tabulations were performed by this computer. The following is a summary of classification schemes employed to provide individual data sets for the artifact analyses presented in subsequent chapters of this report.

1) For all proveniences, chipped and ground stone artifacts were classified according to morpho-functional categories (i.e., shape and common use). Observations of the condition of the piece such as heat treatment and presence of cortex and measurements of length, width and thickness were recorded, where possible, for each object (Table 3.1). It should be noted here that morpho-functional categories employed in DELOS classification are based on the morphological properties of artifacts (i.e., their shape), and do not imply independent determination of every function these artifacts may have actually served when they were used by prehistoric people. If an artifact is classified as a "dart point," for example, it is because the artifact possesses the characteristic shape of such an implement. It may in fact have been used for other purposes, but only highly specialized microscopic examination of use-wear traces on the artifact would permit a more conclusive determination of its function. Functional classifications based on morphological characteristics alone, such as the one employed in this report (as well as similar versions commonly used by archeologists) are therefore best taken as plausible hypotheses that should be further tested.

2) Ceramics were size graded and classified according to temper and vessel part (rim, body, base), and additional observations were recorded concerning the decoration and thickness for each sherd (Table 3.2).

3) Unmodified raw material was counted and weighed by size grade.

4) Flakes and other chipping debris were treated according to the classification scheme described in Table 3.3.

Artifact and Other Material Analyses

The basic analyses undertaken using the various data sets identified in the preceding discussion duplicated those of the 1988 study (Sabo et al. 1990:69-75). A brief description of these analyses is presented below. The units of analysis were derived from the research objectives stated in Chapter 2, but were also conducted within very real budget constraints. The 1990 excavations, like the previous excavations, collected more material from controlled contexts than could be analyzed with available funds. Those collections that were not analyzed were thoroughly dried and prepared for curation unsorted.

The Dalton Area analysis focused exclusively on the screened artifact samples, predominately lithics, from the individual unit levels. Though flotation samples were collected from each level, the 1988 excavation showed the stratum lacked preserved subsistence indicators and none were analyzed by specialists. The one feature defined in the 1b/2a sediments proved to be a natural phenomenon and the flotation contents were not analyzed.

The collections from Stratum 5 in the Lower Midden Area were analyzed according to priorities set by the Principal Investigator and Project Archeologist. The prehistoric pit features were chosen as the most important units of analysis because they represent sealed contexts. Floral and faunal subsistence indicators, artifact content and radiometric dating samples from the features were analyzed. Floral remains from midden levels, including a possible living floor in one 2 x 2 m unit were analyzed for a comparison to the feature contexts. The screened artifact samples from unit levels used in defining assemblages for Stratum 5, 4 and 3 were the next analytical priority. The 1988 excavations indicated that faunal remains were of limited utility because of possible prehistoric mixing in the Stratum 5 midden and poorly preserved in lower strata. Flotation samples and other subsistence indicators, such as mussel and snail shells, from the general midden and lower strata were therefore excluded from analysis. More complex statistical analyses of these prioritized data were not attempted because of the time and funding available for the analysis phase of the project. However, the excavations in the near surface strata were sufficient to permit reconstruction of activity profiles based on functional assessments of the artifact assemblages.

Table 3.1 Artifact classification for 3MR80-Area D.

Artifact Category	DELOS Acronym
Chipped Stone Artifacts	
Arrow	ARROW
Dart	DART
Knife	KNIFE
Other biface tool	BIFK
Hafted biface tool	HBIFK
End scraper	END
Side scraper	SIDE
Side and end scraper	SIND
Thumbnail scraper	THUMB
Spokeshave	SPOKS
Denticulate scraper	DENSCR
Other scraper	SCR
Drill	DRILL
Drill/Awl	DRAWL
Perforator/Graver	PERG
Graver	GRAV
Core tool	CORETO
Arrow Preform	ARRPFM
Dart Preform	DARPFM
Other Preform	PREFRM
Tabular core	TABC
Shaped core	SHAP
Pebble core	PEBCO
Unprepared core	UNPREP
Tested Pebble	TP
Tested Cobble	TC
Hammer	HAM
Adze	ADZE
Celt	CELT
Unmodified Raw Material	URM
Ground Stone Artifacts	
Mano	MANO
Pitted stone	PITS
Polished stone	POLSTN
Cobble	COBL
Cobble tool	COBTO
Ceramics	
Sherd (less than 0.64 cm)	SHERD
Rim sherd	RIM
Body sherd	BODY
Base sherd	BASE

Table 3.2 Attributes encoded for artifacts from 3MR80-Area D.

Field Serial Number (FSN)
Lab Serial Number (LSN)
Artifact Serial Number (ASN)
Artifact Category

General Artifact Category:
CL = Chipped Lithic
GRL = Ground Lithic
POT = Ceramic

Specific Artifact Category (see Table 3.1)
Raw Material:
LBOONE = light Boone chert
GBOONE = gray Boone chert
BBOONE = blue Boone chert
STJOEG = green St. Joe chert
STJOEJ = jasper St. Joe chert
REEDSB = brown Reeds Spring chert
REEDSG = gray/green Reeds Spring chert
PITKIN = Pitkin chert
COTTER = Cotter chert
JEFCIT = Jefferson City chert
NOV = Novaculite
QZIT = Quartzite
QXL = Quartz Crystal
CALXL = Calcite Crystal
SS = Sandstone
LS = Limestone

Weight (for cores and unmodified raw material only)
Whole or Fragment
Type of Fragment (proximal, medial, distal)
Presence/Absence Heat Treatment for Chipped Lithics
Presence/Absence Cortex for Chipped Lithics
Type/Variety

Measurement:
Length/Width/Thickness for Chipped and Ground Lithics
Size Grade for Cores (5.08, 3.81, 2.54, 1.27, 0.64 cm)
Thickness for ceramic sherds

Other Qualifiers:
Haft element and shape for chipped lithics
Temper for ceramics
BOSH = bone and shell
GROBON = grog and bone
GROG = grog
GROSH = grog and shell
SHELL = shell
SHELGRIT = shell and grit
SANGRIT = sand and grit

Table 3.3 Classification for Chipped Stone Debitage.

Category	DELOS Acronym
Unmodified flake	FLA
Modified flake	RUM
Shatter	SHAT

1. Each category sorted by size grade
2. Each category and size sorted by raw material type
3. Weights recorded for all sorted groups
4. Counts recorded for all sorted groups except 0.64 cm size grade

1) Assemblage Characterization by Component. The first analytic step was an assessment of the horizontal and vertical distribution of temporally diagnostic artifacts, primarily projectile points and ceramics, to refine the cultural components and stratigraphic relationships defined in 1988. The 1990 investigation concentrated on Strata 4 and 5 in the lower midden area, and Strata 1b and 2a in the Dalton area.

2) Functional Assessment of Artifact Assemblages by Component. As noted above, finished artifacts and identifiable fragments were classified into functional categories based on morphological (shape) attributes. The distribution of artifacts within these functional categories was used to reconstruct an activity profile for each identified component.

3) Ceramic Attribute Analysis. A large number of ceramic sherds were again collected during our excavations, but delineation of types and varieties was not possible given the rarity of decorated sherds. Most are undecorated and do not lend themselves to a detailed analysis beyond an assessment of temper, rim shape and configuration, and sherd thickness attributes. When added to the ceramics reported from the 1988 investigation, this collection represents a unique assemblage for an open habitation site in the Ozarks.

4) Stone Tool-Making Technology. The chipped stone artifacts and debitage from the block excavations at the Dirst site were examined to reconstruct the subtractive technologies employed to produce stone tools in the Stratum 4 and 5 components of the Lower Midden Area and the 1b/2a components of the Dalton Area at 3MR80-Area D. The approach employed for this analysis was developed by Sabo in 1988 (1990:195-200). Sabo's approach was modified from one developed by Marvin Kay in an analysis of artifacts from the Cedar Grove site (Kay 1984), a late prehistoric Caddo habitation in southwest Arkansas.

5) Stone Resource Utilization. The same chipped stone collections from the block excavations were also employed in investigating the utilization of chert resources from identifiable bedrock sources. This was accomplished using material type collections from the 1988 excavations. The initial identifications were drawn from the Arkansas geological base map and other data layers available in the Survey's computerized Geographical Information System.

6) Other Analyses. Dr. Margaret Guccione of the University of Arkansas has prepared a geomorphological history of the Buffalo River drainage. The synthesis is based upon her analysis of the immediate terrace area of 3MR80-Area D and three other NPS funded geomorphological studies she conducted upstream of the Rush locality. Floral and faunal specimens collected from features and excavation units within the lower midden zone of the site were sent to specialists for identification and interpretation. Ms. Sandra L. Dunavan of the University of Michigan Museum of Anthropology performed the analysis of floral remains. Ms. Susan L. Scott of Scott and Associates, Hattiesburg, Mississippi, performed the analysis of faunal remains. Three samples of carbonized plant material were also submitted to Beta Analytic, Inc. of Coral Gables Florida, for .pa

radiocarbon dating. The maize samples from Feature 4 were also submitted to Geosciences Management Institute of Boulder City, Nevada for an Accelerator Mass Spectrometry date.

Collection Curation

The material collections from the Rush project are presently contained in 97 standard (22 in x 22 in) storage boxes. All collections, including artifacts, maps, specimens, samples, notes, photographs, computer data files, and other documentation are curated with the Arkansas Archeological Survey in Fayetteville in accordance with the curation agreement in effect with the National Park Service (Subagreement 2 to Cooperative Agreement Number 7029-8-0007). All artifacts, samples, and storage containers are labeled with an accession number determined by the Office of the State Archeologist and in accordance to the Curation Standards put forth in Appendix J of the State Plan for the Conservation of Archeological Resources in Arkansas (Davis 1982; revised 1989), as well as the curation standards outlined in Subagreement Number Two with the National Park Service.

CHAPTER 4

Geomorphology of the Buffalo River

MARGARET J. GUCCIONE

Introduction

The purpose of this chapter is to characterize the valley floor of the Buffalo River and to model the known and predicted locations of archeological deposits within its present landforms. The present study builds upon previous geomorphic studies conducted at archeological site locations in the river valley to examine the geomorphological context among the sites. The study is meant to complement both the archeological objectives of the Dirst site investigations and future archeological investigations by providing a model of depositional contexts for evaluating the presence or absence of buried cultural resources within the Buffalo National River.

To date five archeological sites on the valley floor have had detailed geomorphic and sedimentologic field analyses: the Luallen (3NW662) and Sattler Sites (3NW663) at Boxley, Arkansas (Guccione 1989a), the Elk Track (3NW205) and Webb Branch Sites (3NW206) at Erbie, Arkansas (Guccione 1988), and the Dirst Site (3MR80) at Rush, Arkansas (Guccione and Guendling 1990). A sixth archeological site, the Dry Ford Site (3NW507), located on a possible high terrace along the valley wall, has also been studied (Guccione 1989b). Detailed descriptions of the sediments were made at all six sites, and textural analysis of soil samples were taken from the exposures in backhoe trenches or hand excavations. These studies provide a depositional history and environmental context assessment of the immediate area surrounding each archeological site. They also provided a three dimensional assessment of sedimentation processes on archeologically dated landforms in the river valley at four different locations.

The results of these studies suggest three generalizations that seemed to characterize the Buffalo River Valley: 1) the width of the valley decreases as one moves downstream, 2) the thickness of overbank deposits associated with the lowest terrace increases downstream, and 3) the age of the lowest terrace surface decreases downstream. A major objective of this study was to evaluate these three generalizations.

This was done by characterizing the geometry of the valley floor, mapping the geomorphic surfaces within the valley bottom using the topography, determining the type of sediment that underlies the geomorphic surfaces, and interpreting its environment of deposition. Relative dating of these surfaces and the sediment that underlies them was accomplished using elevation above the floodplain and the degree of soil development. Nearly all of the analyses have been done utilizing topographic, geologic, and soils maps. The results of this study should thus be used as a large-scale first approximation for the potential of preservation and possible age of archeological sites along the river valley. Further field research should be incorporated in this model to provide refinements and corrections that will surely be needed.

Study Area

The Buffalo River is a meandering river deeply incised into Paleozoic bedrock. It flows through the Ozark Plateaus Province in north-central Arkansas. Its steep bluffs, narrow valley floor, and local rapids provide a natural beauty that has been appreciated and utilized for its resources for millennia.

The study area is located near the southern margin of the North American craton. A thin succession of shallow-water Paleozoic carbonate, shale, and sandstone cover Precambrian igneous and metamorphic rocks. Deformation of these strata is slight: the rocks dip at low angles to the southwest away from the Ozark Dome in southeastern Missouri. A few normal faults, which formed as the Arkoma foreland basin developed to the south, are generally oriented east-west.

On the basis of physiography the study area is located in the Ozark Plateaus Province (Figure 4.1) (Thornbury 1965). This province includes an east-central domal uplift, the St. Francis Mountains in southeast Missouri, and three plateaus, all of which dip gently away from the dome. The Salem Plateau is underlain by Ordovician carbonate strata, the Springfield Plateau is underlain by Mississippian carbonate strata, and the Boston Mountain Plateau is underlain by Pennsylvanian sandstone and shale strata. These plateaus are separated by escarpments which face toward the St. Francis Mountains. The Eureka Springs Escarpment rises from the Salem Plateau to the Springfield Plateau and the Boston Mountain Escarpment rises from the Springfield Plateau to the Boston Mountain Plateau.

The Buffalo River deeply dissects all three plateau surfaces (Figure 4.2) and its channel is eroding Pennsylvanian, Mississippian, and Ordovician strata throughout most of its course (Figure 4.3) (Haley et al. 1976). The headwaters flow south, east, and north across the Boston Mountain Plateau. In a reentrant of the Boston Mountain Escarpment the river makes a right angle bend and flows generally east across the Springfield and Salem plateaus to its confluence with the White River on the Salem Plateau.

Methods

The focus of this report is to integrate observations of field studies at Boxley, Erbie, Dry Ford and Rush (Guccione 1988; 1989a; 1989b; and Guccione and Guendling 1990) with map analyses of the Buffalo River. Topographic map analysis of valley and channel morphology includes measurements of the longitudinal profile (stream gradient), valley morphology (width, relief and bluff height) and channel morphology (sinuosity, meander amplitude and wavelength). These variables characterize the landforms in the valley and control channel migration and incision as well as the rate of deposition and erosion within a given river segment. Map analyses of the bedrock, alluvial sediment, and the soil developed within these parent materials utilized the state geologic map (Haley et al. 1976) and county soil survey maps (Ward and McCright 1983; Fowlkes et al. 1988; Fowlkes et al. in press). These variables characterize the sediments throughout the valley and provide relative aging of sediments based upon soil development.

The longitudinal profile of the Buffalo and Little Buffalo Rivers was determined by plotting the elevation of the river at each point where a contour line crossed the river against the distance downstream. The distance downstream is measured from the location where the streams become permanent and is referred to as river kilometers.

Stream gradient was calculated as the change in elevation between two points along the river divided by the river distance between those two points. Gradient was determined for each river length between contour lines. Therefore a gradient was calculated for each 20 or 40 foot change in elevation (depending on the contour interval of the topographic map) of the river channel. The gradient was plotted against the river kilometer.

Measurement of the valley morphology included the valley floor width, maximum valley relief, and maximum bluff height. Width of the valley floor was measured every 1.5 km distance along the channel of the Buffalo and Little Buffalo Rivers. A break in slope was used as the criteria to determine the edge of the valley wall and the thus valley floor was the distance between the two valley walls. Where the location of the valley wall was questionable, soil survey maps were consulted to determine where the contact between bedrock soil and flood-plain or terrace soil occurred. For each segment of the Buffalo River, the mean valley width was calculated.

Maximum valley relief was measured as the difference in elevation between the highest elevation of the nearest plateau surface and the lowest elevation of the valley floor. Bluff height was measured as the difference in

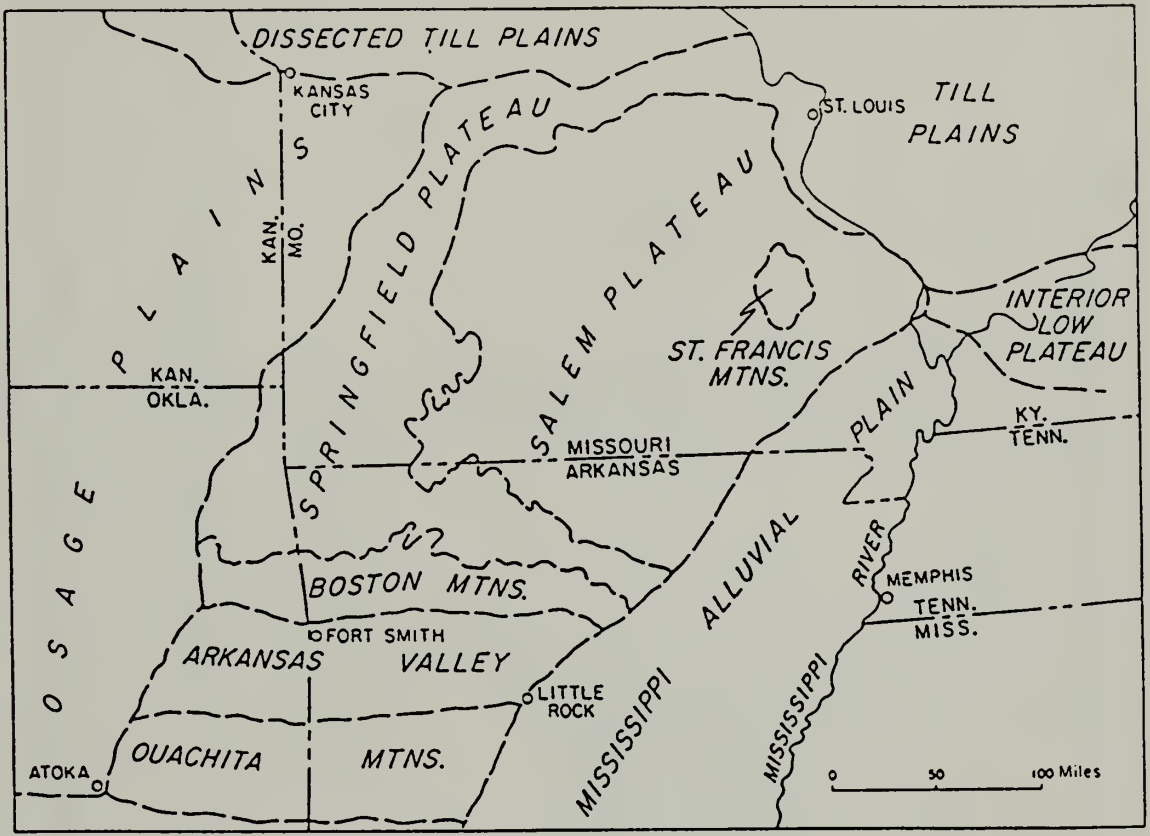


Figure 4.1. Physiographic provinces of the south-central United States (from Thornbury 1965, Figure 14-2).

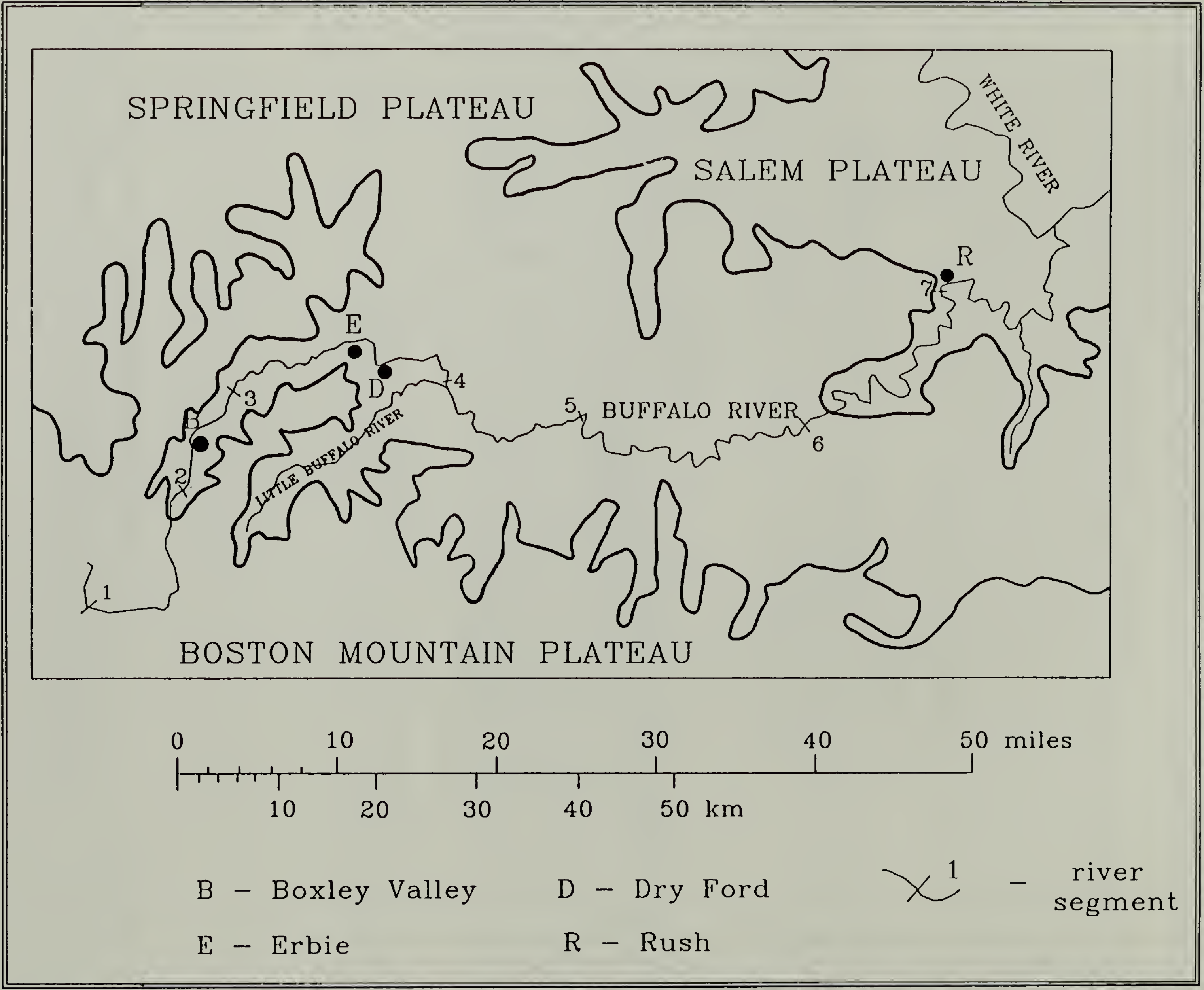
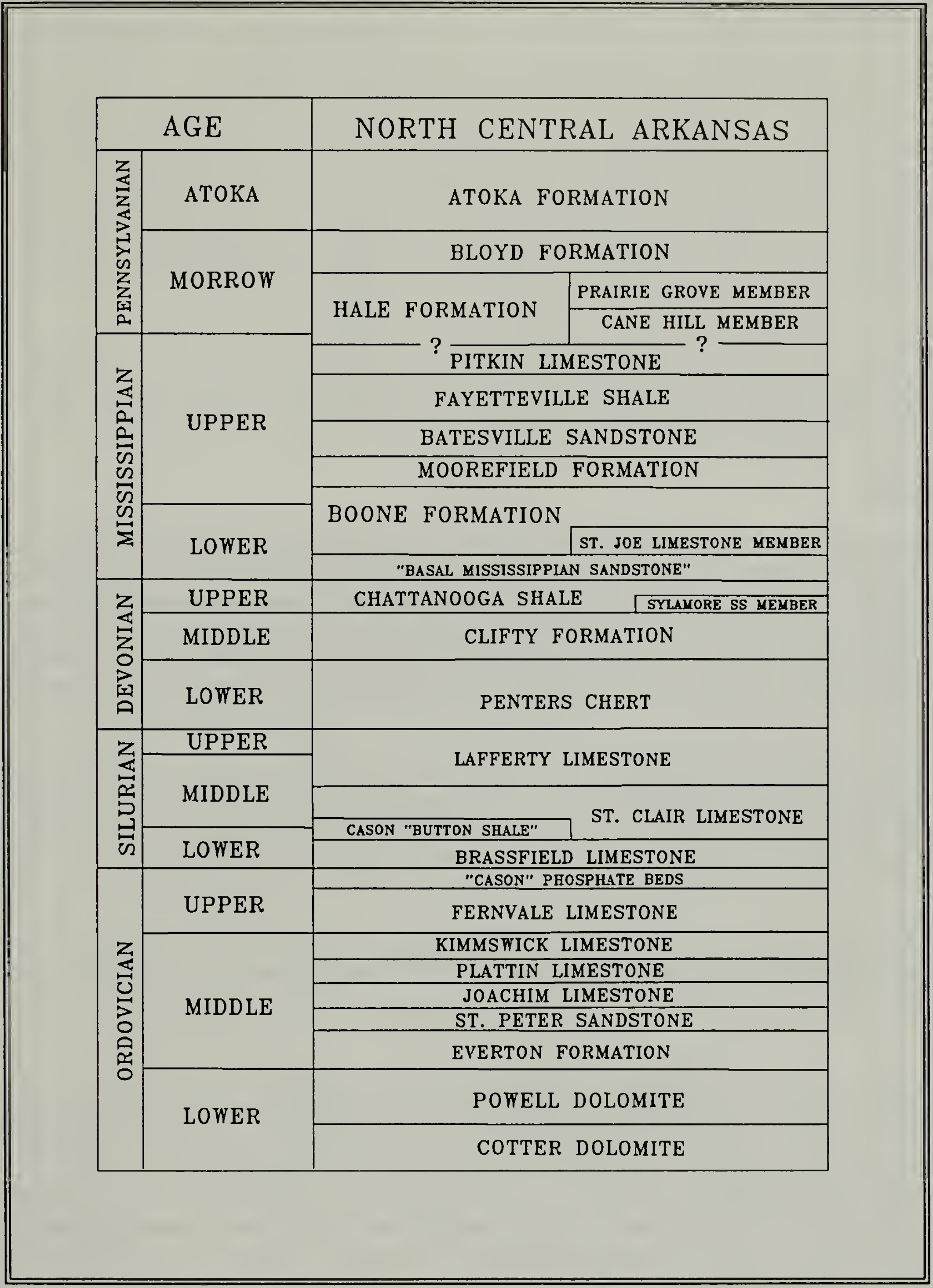


Figure 4.2. Buffalo River study area, physiographic plateaus, river segments and geologic study sites.



AGE		NORTH CENTRAL ARKANSAS	
PENNSYLVANIAN	ATOKA	ATOKA FORMATION	
	MORROW	BLOYD FORMATION	
		HALE FORMATION	PRAIRIE GROVE MEMBER
			CANE HILL MEMBER
		?	?
MISSISSIPPIAN	UPPER	PITKIN LIMESTONE	
		FAYETTEVILLE SHALE	
		BATESVILLE SANDSTONE	
		MOOREFIELD FORMATION	
	LOWER	BOONE FORMATION	
			ST. JOE LIMESTONE MEMBER
		"BASAL MISSISSIPPIAN SANDSTONE"	
DEVONIAN	UPPER	CHATTANOOGA SHALE	SYLAMORE SS MEMBER
	MIDDLE	CLIFTY FORMATION	
	LOWER	PENTERS CHERT	
SILURIAN	UPPER	LAFFERTY LIMESTONE	
	MIDDLE	CASON "BUTTON SHALE"	ST. CLAIR LIMESTONE
	LOWER	BRASSFIELD LIMESTONE	
ORDOVICIAN	UPPER	"CASON" PHOSPHATE BEDS	
		FERNVALE LIMESTONE	
	MIDDLE	KIMMSWICK LIMESTONE	
		PLATTIN LIMESTONE	
		JOACHIM LIMESTONE	
		ST. PETER SANDSTONE	
		EVERTON FORMATION	
	LOWER	POWELL DOLOMITE	
		COTTER DOLOMITE	

Figure 4.3. Stratigraphic column of north-central Arkansas (after Bush et al., 1980).

elevation between the channel and a decrease in slope at steep cutbanks of the Buffalo River. The maximum bluff height of each river segment was noted.

Quantification of channel morphology included measurement of sinuosity and meander wave length and amplitude. Sinuosity of the channel is the length of the channel divided by the length of the valley and was calculated along the entire length of the Buffalo River. Upstream of river kilometer 34 where the river is nearly straight, the sinuosity was measured along every 1.5 kilometer length of the river and downstream of river kilometer 34 where the river meanders, the sinuosity was measured for every meander. The mean of the sinuosity within each segment was also determined. Because of the complexity of meanders, the meander geometry of Leopold et al. (1964) was modified as follows. The meander wave length is considered to be the straightline distance between the apex of one meander cutbank (Figure 4.4, point A) and the third meander cutbank (Figure 4.4, point C) downstream. The meander amplitude is the shortest distance between the outer cutbank at the axis of one meander bend (Figure 4.5, point B) and a straight line joining the outer cutbanks at the axes of the two adjacent meander bends (points A and C). Both the meander wave length and amplitude were measured for each meander along the length of the Buffalo River, beginning at river kilometer 34.

Distribution of the soil series developed in alluvium along the valley floor was examined using soil survey maps (Ward and McCright 1983; Fowlkes et al. 1988; Fowlkes et al. in press). A map of at least one typical area from each segment along the Buffalo River was reproduced and is included in this report. A typical topographic cross section accompanies the soil map of the valley floor.

Geomorphology

The Buffalo River is a degrading stream, deeply incised into horizontal sedimentary bedrock of the Ozark Plateaus Province. It has created an erosional topography with only a minor area of depositional topography along the valley floor. The river has a typical logarithmic longitudinal stream profile (Figure 4.6). The headwaters occur at an elevation of 622 m (2040 feet) above sea level and its confluence with the White River is at 116 m (380 feet) above sea level. The gradient is steep in the upstream section of the river and decreases logarithmically downstream (Figure 4.7). The variability of the gradient is the greatest in the upper 35 km of the river, intermediate between 35 and 113 km downstream, and very low between 113 km and its confluence.

Seven relatively large tributaries flow into the Buffalo River. From upstream to downstream these are Little Buffalo River, Big Creek, Cave Creek, Richland Creek, Calf Creek, Bear Creek, and Big Creek. Of these tributaries, Little Buffalo River is the largest, relative to the Buffalo River at the point of their confluence. All of the tributaries flow into the Buffalo River in the downstream two thirds of the river, between river kilometers 88 and 223.

The Buffalo River and its tributaries are deeply entrenched into the Ozark Plateaus Province. The uplands are dominated by flat plateau surfaces underlain by more resistant horizontal bedrock. The relief between the uplands and the valley floor is up to 475 m (Figure 4.8), but relief values of 300 m are more common.

Valley walls that descend from the upland divides to the valley floor are steep (Figures 4.9-4.18). Some of the meanders have bluffs up to a hundred meters high along the outside of the meander bends (Figures 4.9, 4.11, 4.12, 4.16, 4.17, and 4.18). More gradual slopes are present along the inside of the bends, forming asymmetric cross sections perpendicular to the valley trend (Figures 4.11, 4.14, 4.16, 4.17, and 4.18).
floodplain extends across the entire valley floor and in other locations terraces are preserved. Up to three terraces have been identified on topographic maps, but preservation of one or two terraces is more common. Because of the narrow valley floor and the incised meandering morphology, the terraces are not very wide and are not continuous for very long distances.

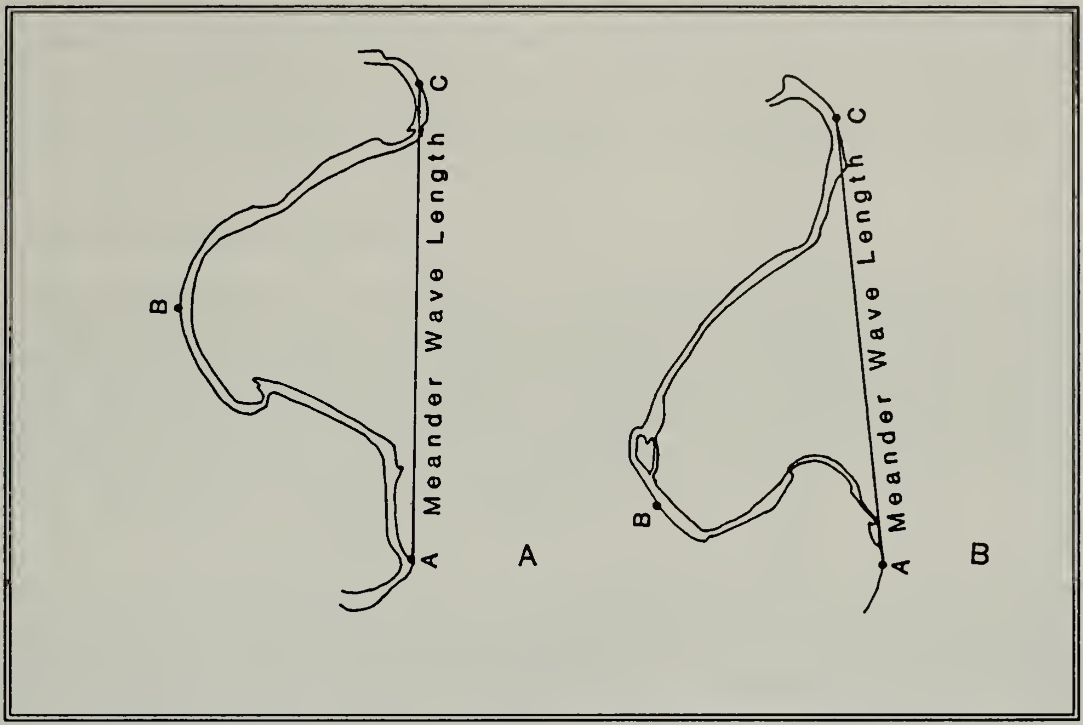


Figure 4.4. Measurement of meander wave length of (A) a simple meander and (B) a complex meander.

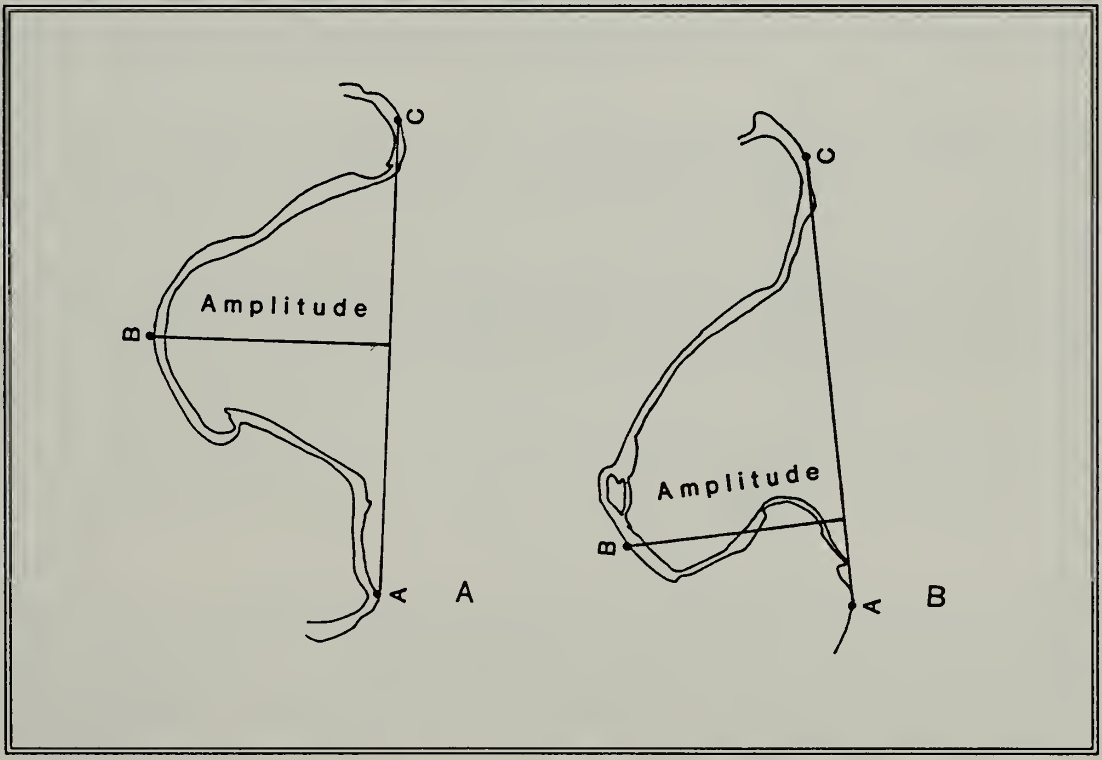


Figure 4.5. Measurement of meander amplitude of (A) a simple meander and (B) a complex meander.

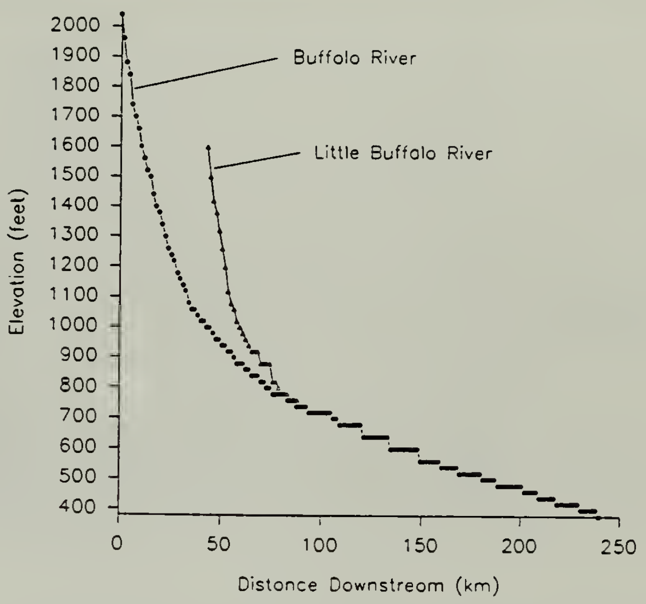


Figure 4.6. Longitudinal profiles of the Buffalo River and Little Buffalo River.

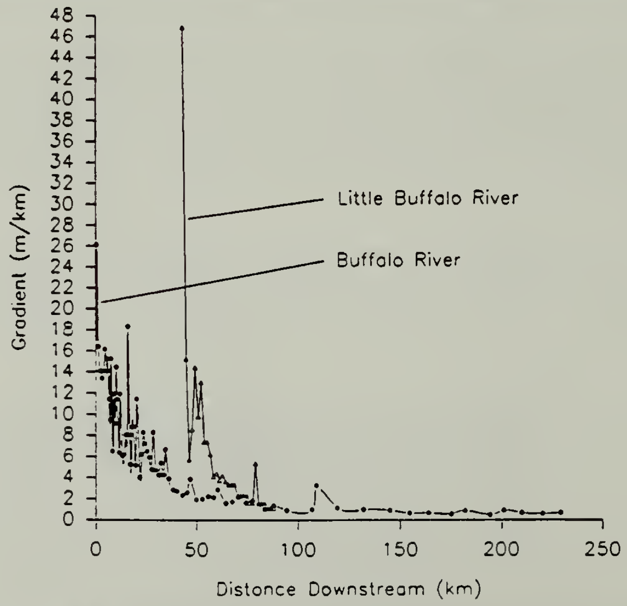


Figure 4.7. Gradient of the Buffalo River and the Little Buffalo River plotted against distance downstream (river kilometers).

Most of the Buffalo River is a meandering stream with sinuosities up to 3.44 (Figure 4.20). Though there is a great deal of variability, the general trend is for the sinuosity to increase from 1.6 where the channel begins to meander to 2.1 downstream. The meander amplitude (Figure 4.21) is also quite variable but the trend is to double from 0.8 km upstream to 1.6 km downstream. A similar trend is present in the meander wave length (Figure 4.22). It is quite variable and also generally increases downstream, from a mean of 1.9 km in the upstream area to 2.5 km at the confluence with the White River. The result is a poorly defined positive correlation of meander amplitude with meander wave length (Figure 4.23).

Characterization of the Buffalo River Valley

Though the morphology of the Buffalo River is highly variable, it can be divided into 7 segments. Within each segment there is a similarity of meander morphology, the nature of the valley floor (Figure 4.24), and to a limited extent, the river channel. In segments where sites have already been studied, the geologic and archeological findings will be generalized to suggest the distribution of buried and surface archeological sites. In segments where studies have not been completed, the geomorphology (as determined using topographic quadrangle maps and soil survey maps) will be used to evaluate the probable sediment type and age and to assess the possible distribution of buried and surface archeological sites.

SEGMENT 1

The first segment of the Buffalo River flows across the Boston Mountain Plateau (Figure 4.2). It extends from its headwaters where the stream becomes perennial to river kilometer 7 at the confluence of Nuckles Creek where the sinuosity increases (Figure 4.20) This segment is termed Main Prong Big Buffalo Creek. All the tributaries are small, ephemeral streams, except for Nuckles Creek. The sandstone and shale bedrock in the drainage area is Pennsylvanian Atoka Formation (Figure 4.3) (Haley et al. 1976).

Relief between the plateau surface and the valley floor is relatively low (Figure 4.8). Because the river has not deeply incised the uplands in this headwater region, the valley walls are moderately steep but no bluffs are present (Figures 4.9 and 4.10). Along the narrow valley floor (Figures 4.19 and 4.24), only a floodplain and channel are present (Figure 4.10). No terraces occur in Segment 1.

Along most of Segment 1 the channel gradient is steep and the channel pattern is straight. The very steep gradient with a high degree of variability is typical of the headwater regions of streams (Figure 4.7). A low sinuosity channel pattern is also typical of stream headwaters (Figures 4.20 and 4.25).

Sediment underlying the narrow floodplain is probably thin. Most of the alluvium is coarse, poorly rounded channel gravel with minor amounts of fine-grained overbank deposits (Fowlkes et al. 1988). The soils mapped in the area reflect the young age and texture of the parent material (Figure 4.10) (Fowlkes et al. 1988). Entisols (Ceda Soil Series) develop in stoney alluvium and weakly developed alfisols (Kenn Soil Series) develop in sandy alluvium over channel gravel. Bedrock soils are also common.

The chance for preservation of archeological sites is minor. If sites are present, they are probably relatively young surface sites because the sediments and land surfaces are probably late Holocene.

SEGMENT 2

The second segment of the Buffalo River erodes into the Boston Mountain Plateau forming the Boston Mountain Escarpment (Figure 4.2). It extends from river kilometer 7 to kilometer 30, where the floodplain abruptly widens (Figures 4.19 and 4.24). The upper 1.5 km of this segment is termed the Main Prong Big Buffalo Creek and the remainder is the Buffalo River. There are numerous small, ephemeral tributaries, but the larger tributaries such as Reeves Fork, Pruitt Hollow, Adkins Creek, Terrapin Branch, Bowers Hollow, and Boen Gulf Branch in the upstream portion of this segment are perennial streams. These tributaries and the Buffalo

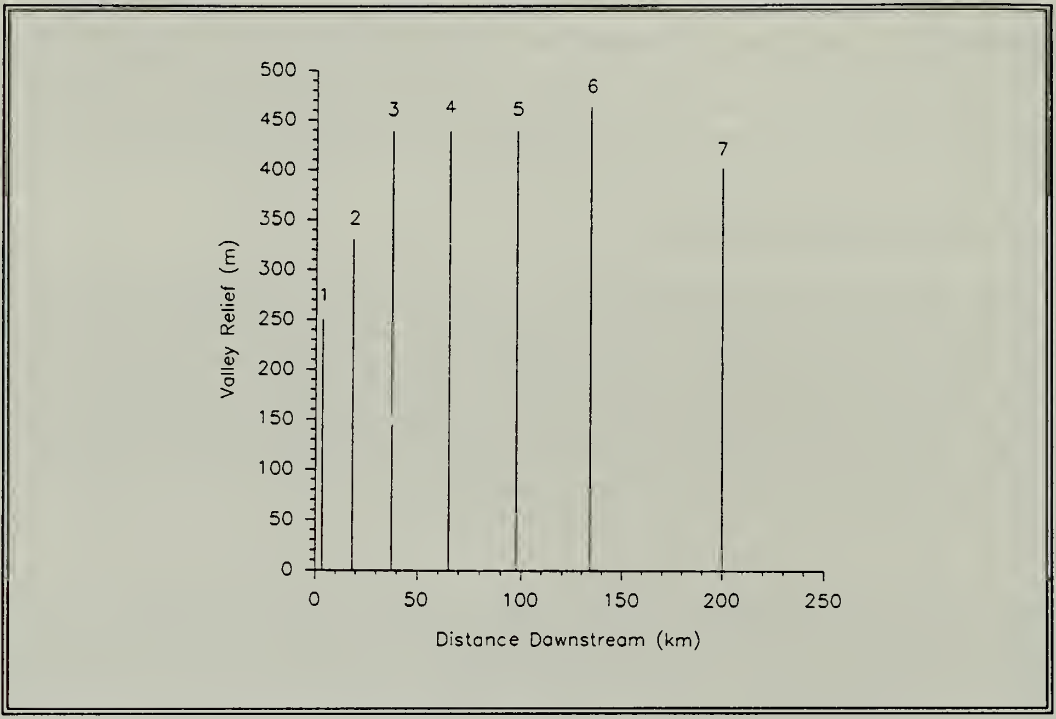


Figure 4.8. Maximum valley relief between highest adjacent plateau surface and river channel for each segment of the Buffalo River.

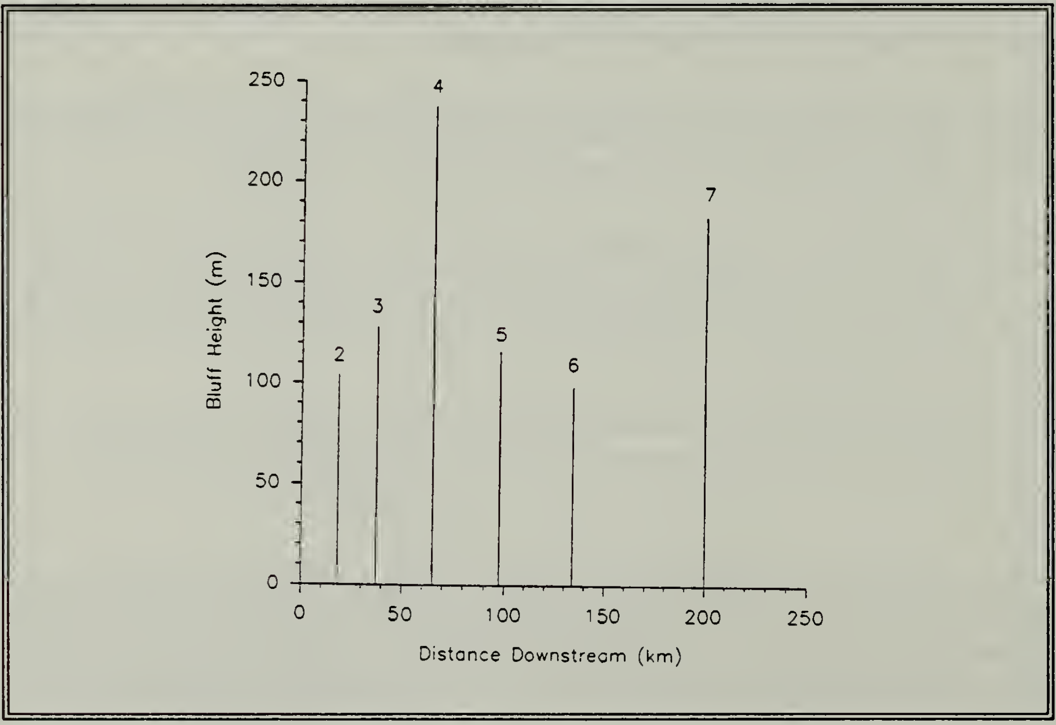


Figure 4.9. Maximum bluff height of the lower valley wall for each segment of the Buffalo River.

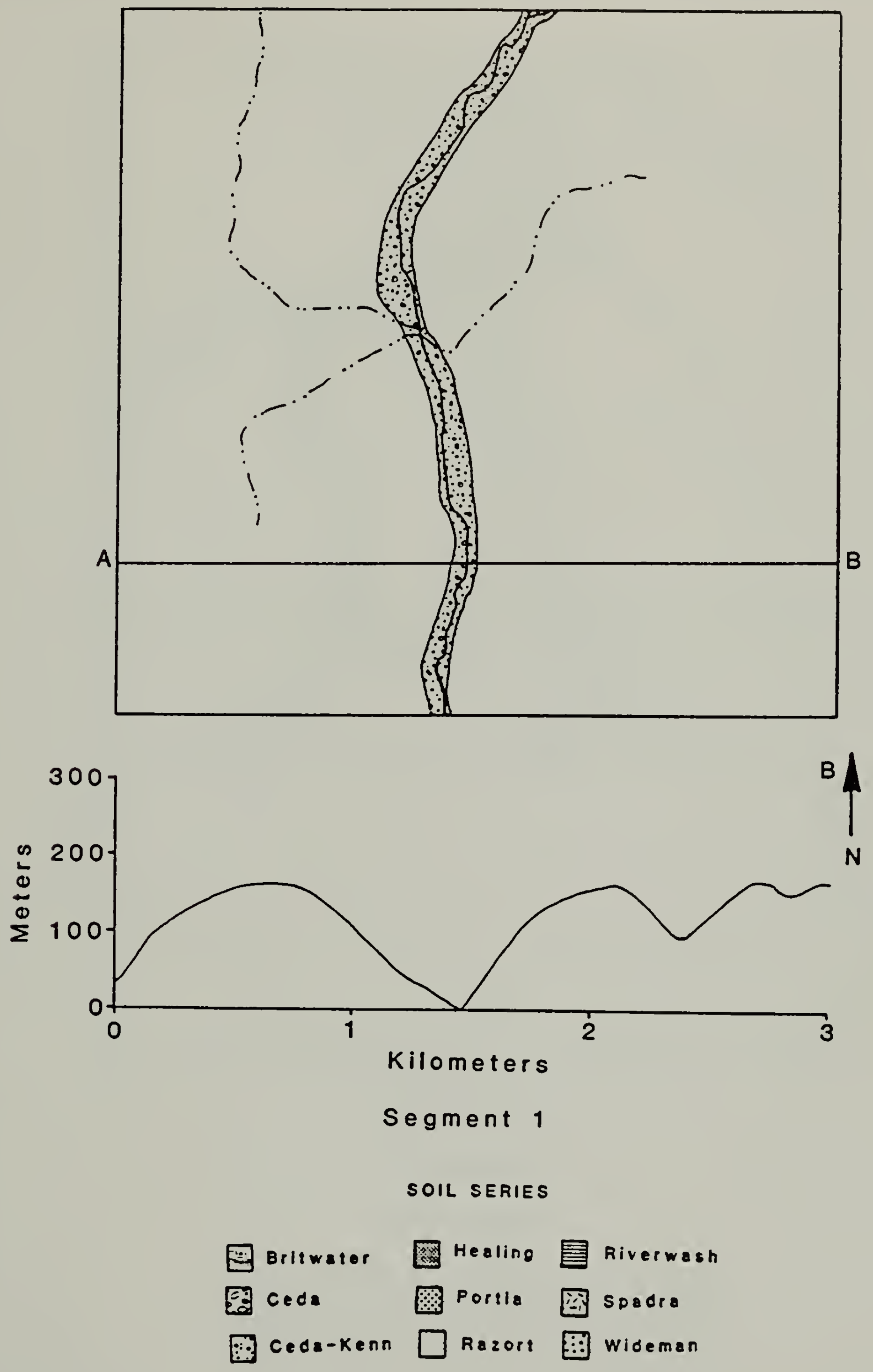


Figure 4.10. Soil map and topographic cross section along a select area of the Buffalo River in segment 1 (Fowlkes et al., 1988, sheet 10).

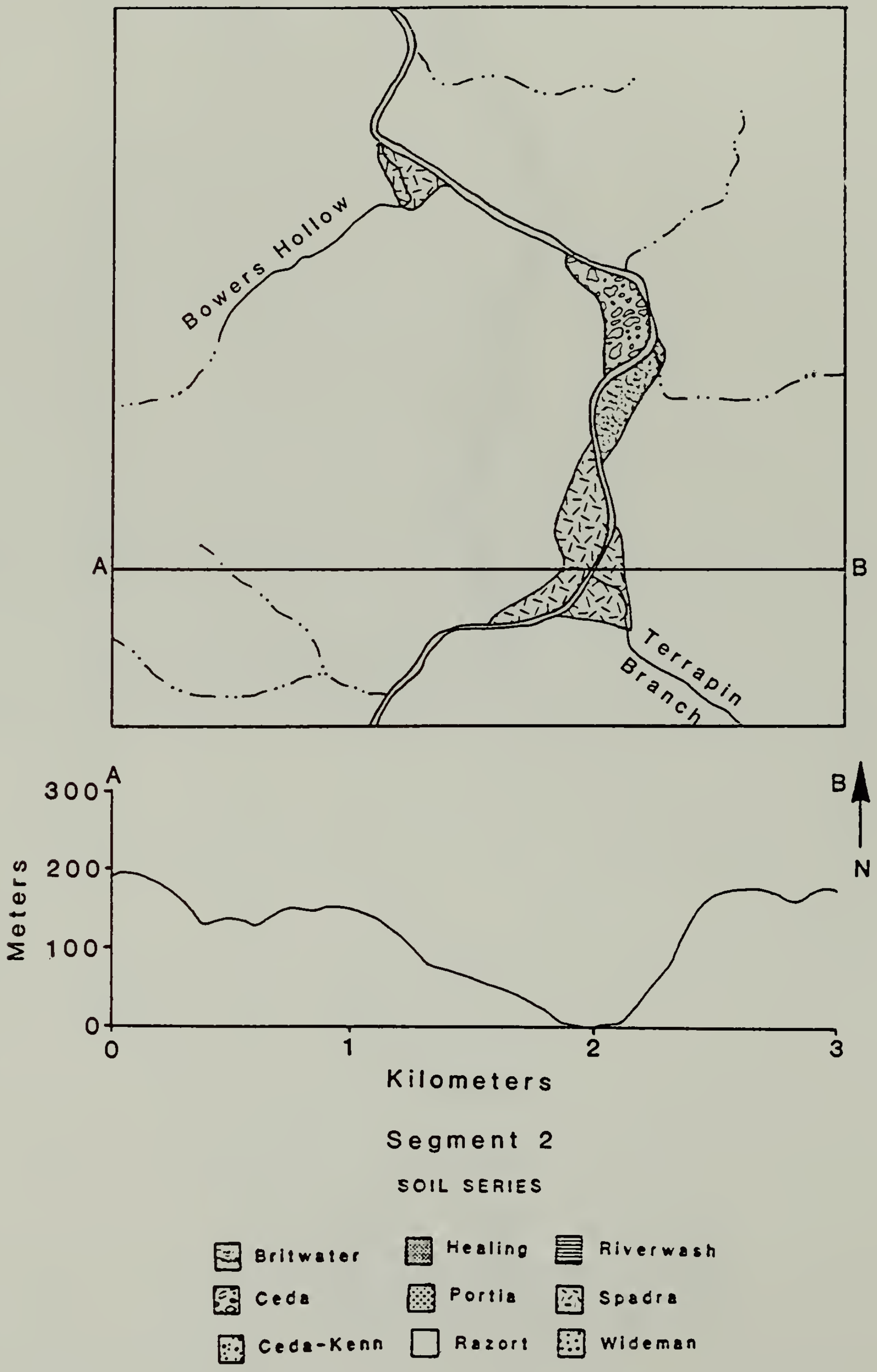


Figure 4.11. Soil map and topographic cross section along a select area of the Buffalo River in segment 2 (Fowlkes et al., 1988, sheet 28).

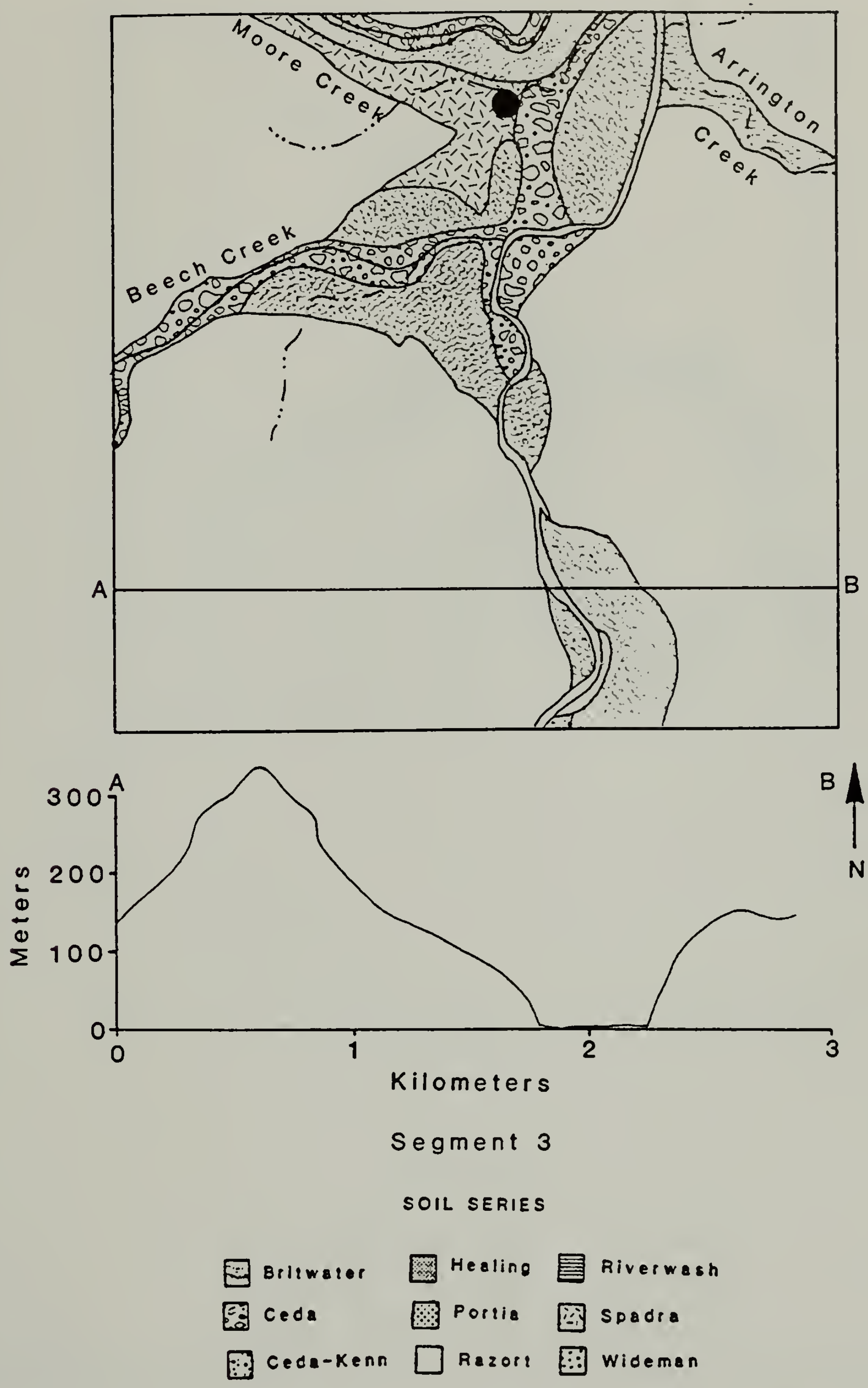


Figure 4.12. Soil map and topographic cross section along a select area of the Buffalo River in segment 3 (Fowlkes et al., 1988, sheets 15 and 19). Dot is the Sattler Site (3NW663) at Boxley, Arkansas.

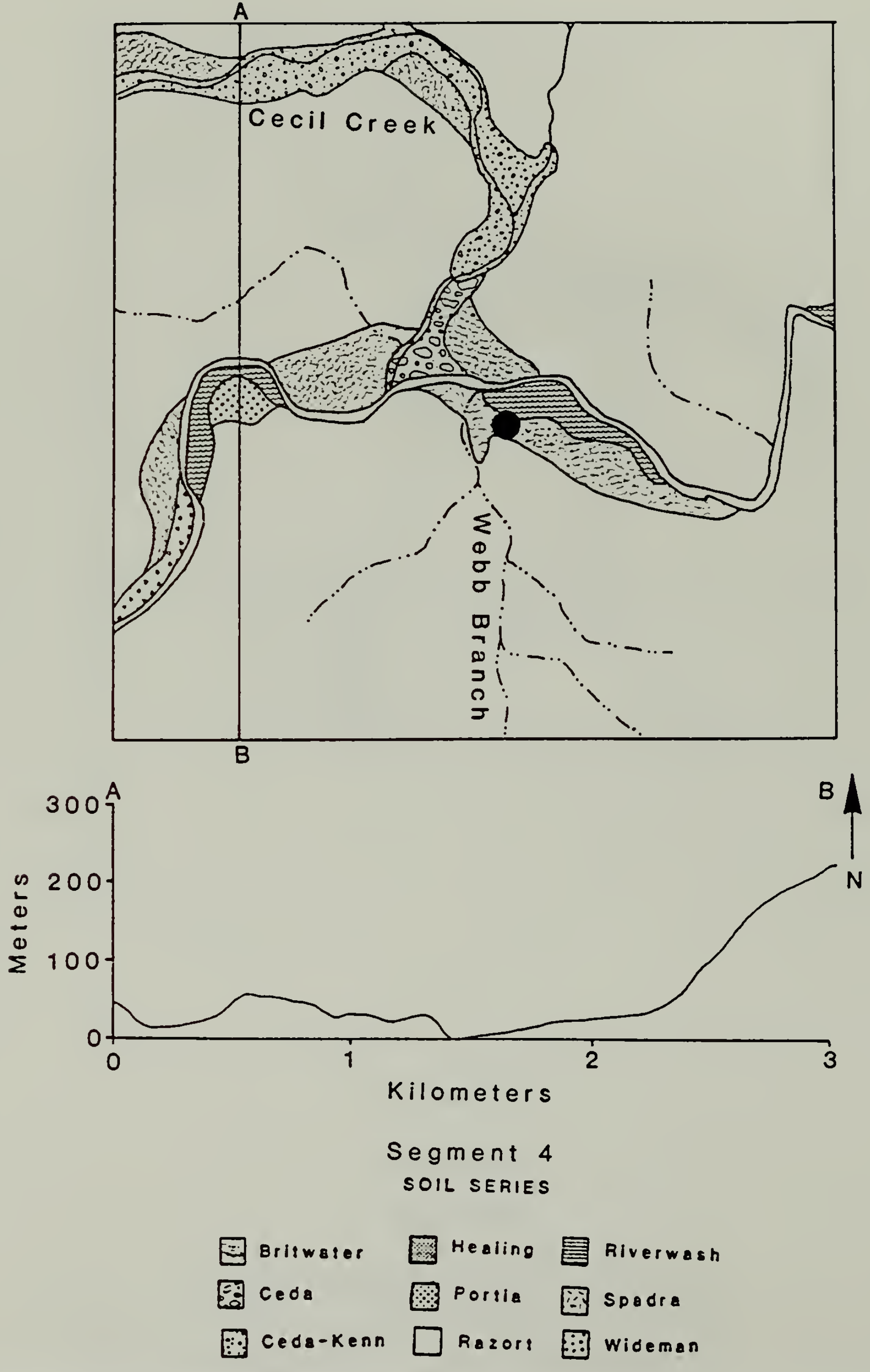


Figure 4.13. Soil Map and topographic cross section along a select area of the Buffalo River in segment 4 (Fowlkes et al., 1988, sheets 3 and 8). Dot is the Elk Track Site (3NW205) and the Webb Branch Site (3NW206) at Erbie, Arkansas.

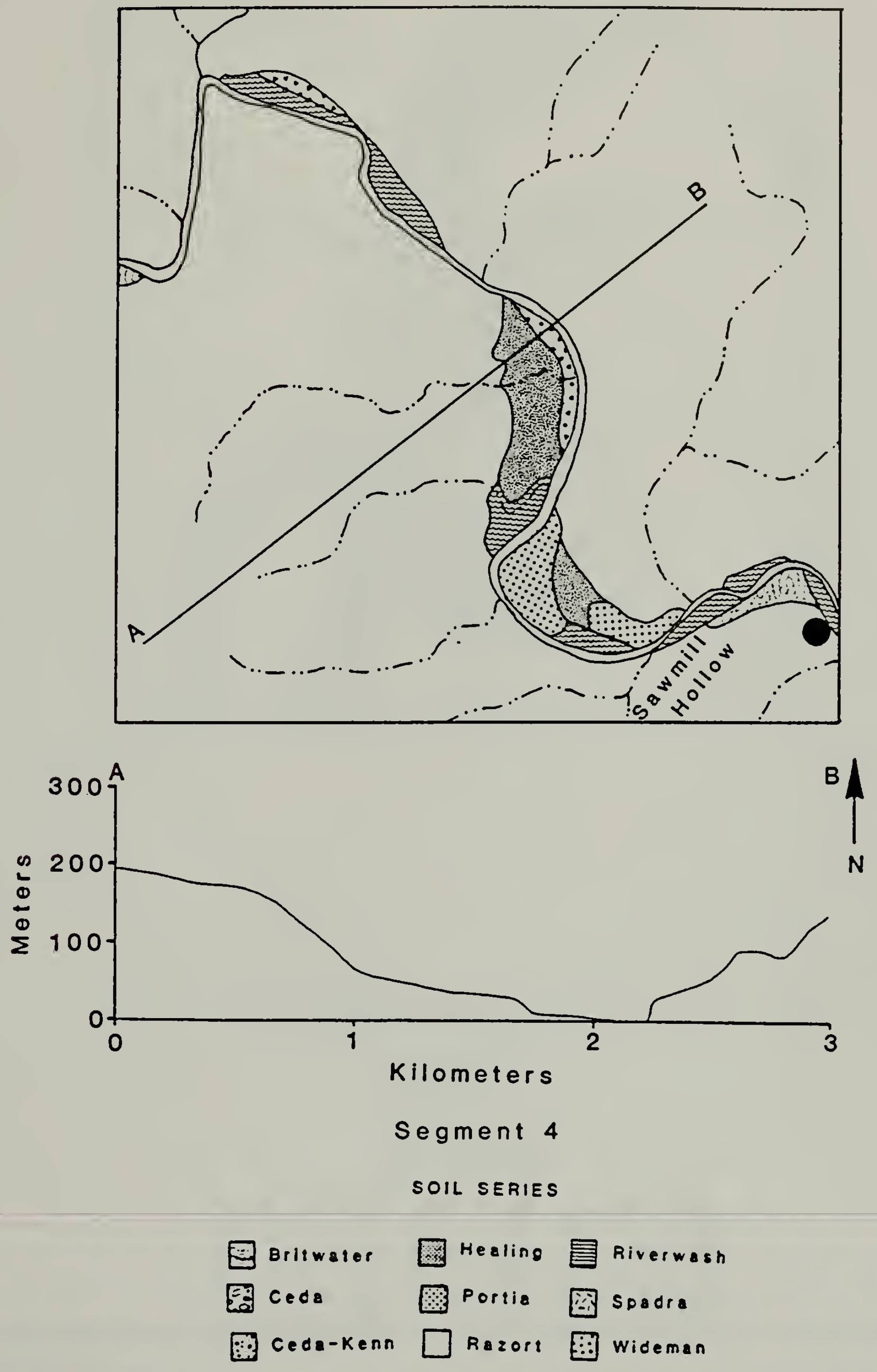


Figure 4.14. Soil Map and topographic cross section along a select area of the Buffalo River in segment 4 (Fowlkes et al., 1988, sheet 8). Dot is the Dry Ford Site (3NW507).

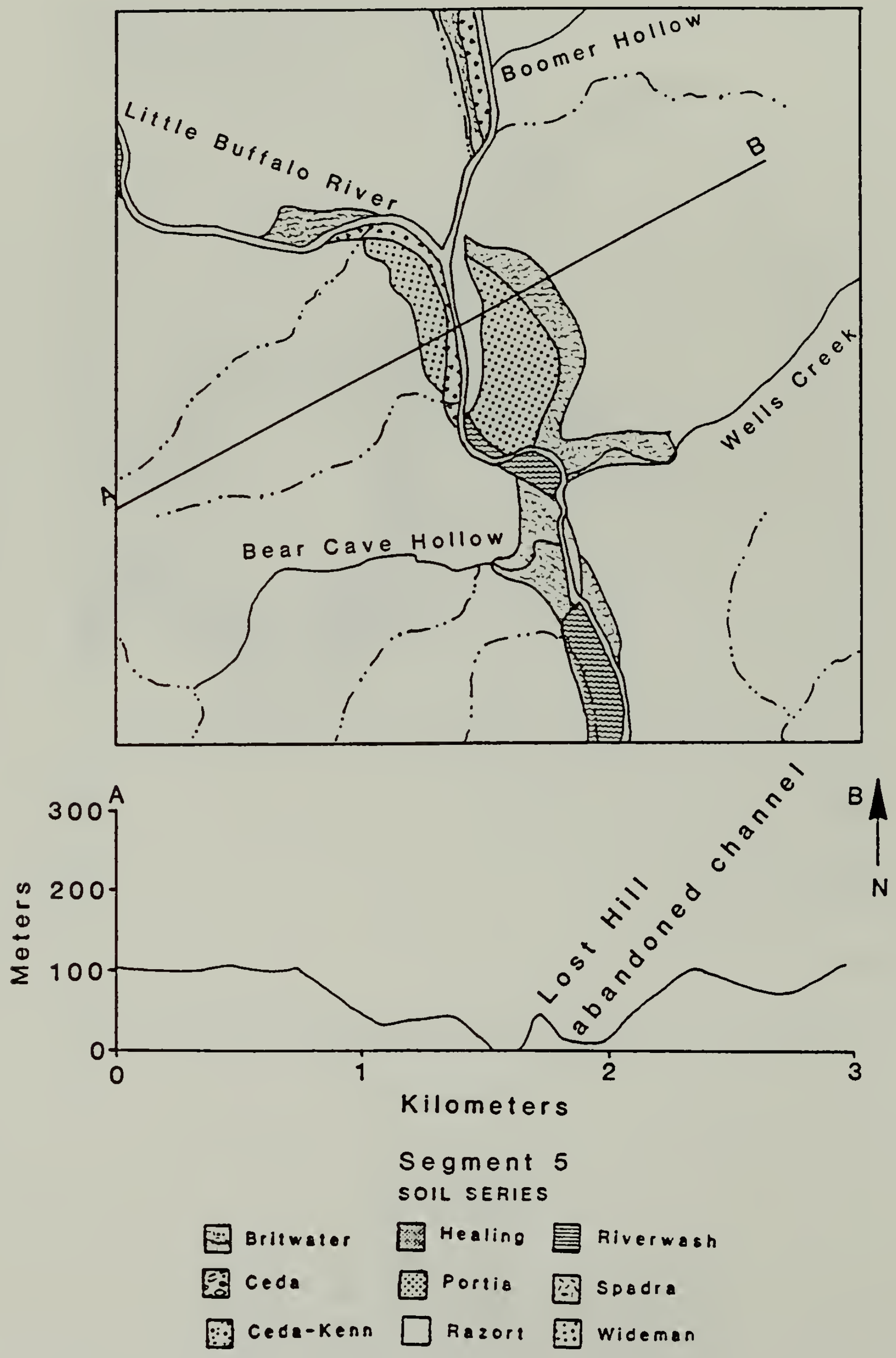


Figure 4.15. Soil Map and topographic cross section along a select area of the Buffalo River in segment 5 (Fowlkes et al., 1988, sheets 13). Lost hill is an old divide or terrace surface separating an abandoned channel of the Buffalo River and the channel of the Little Buffalo River. Today the confluence of the Buffalo and Little Buffalo Rivers is at the north end of Lost Hill.

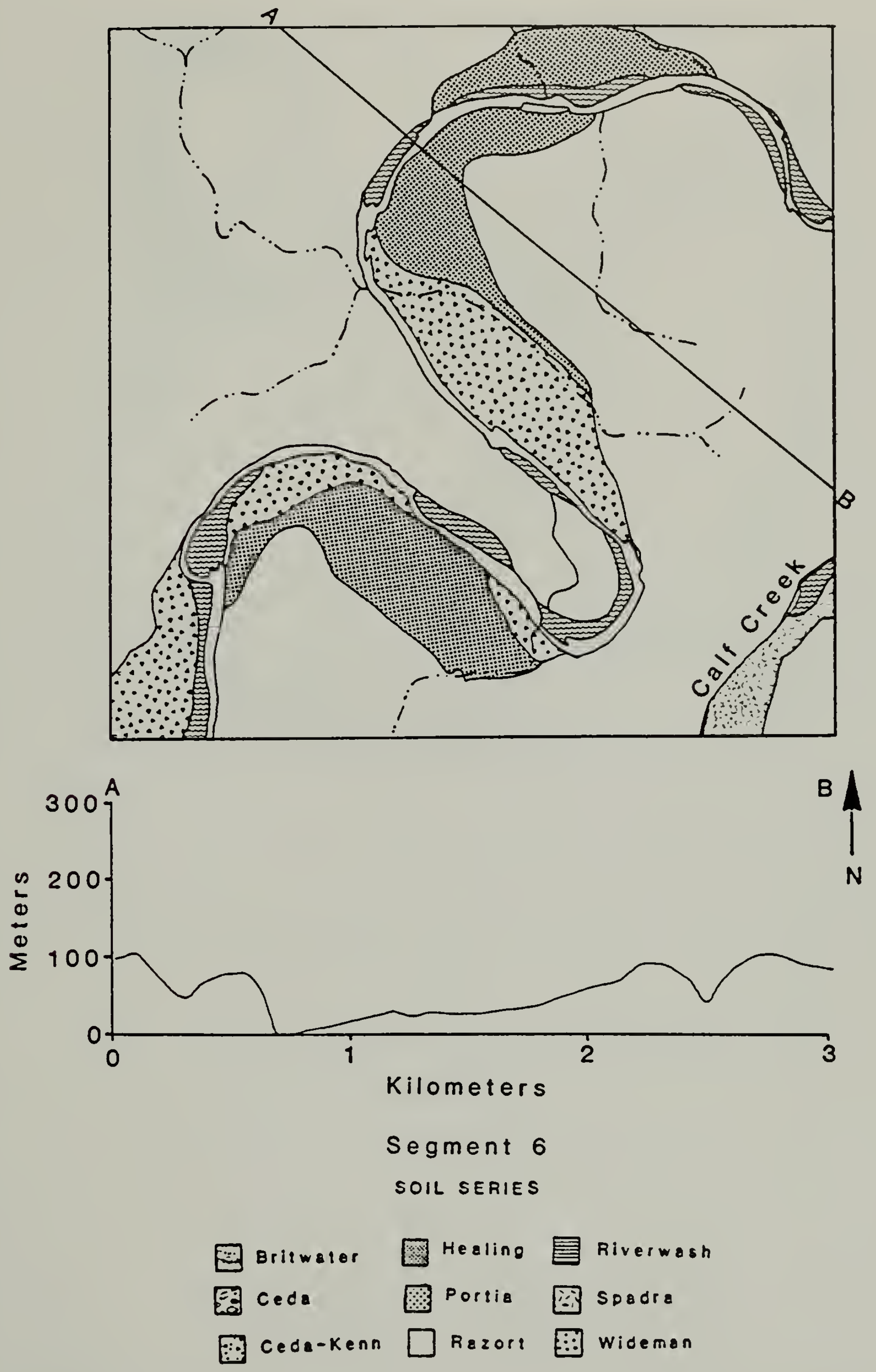


Figure 4.16. Soil Map and topographic cross section along a select area of the Buffalo River in segment 6 (Fowlkes et al., 1988, sheets 13 and 18).

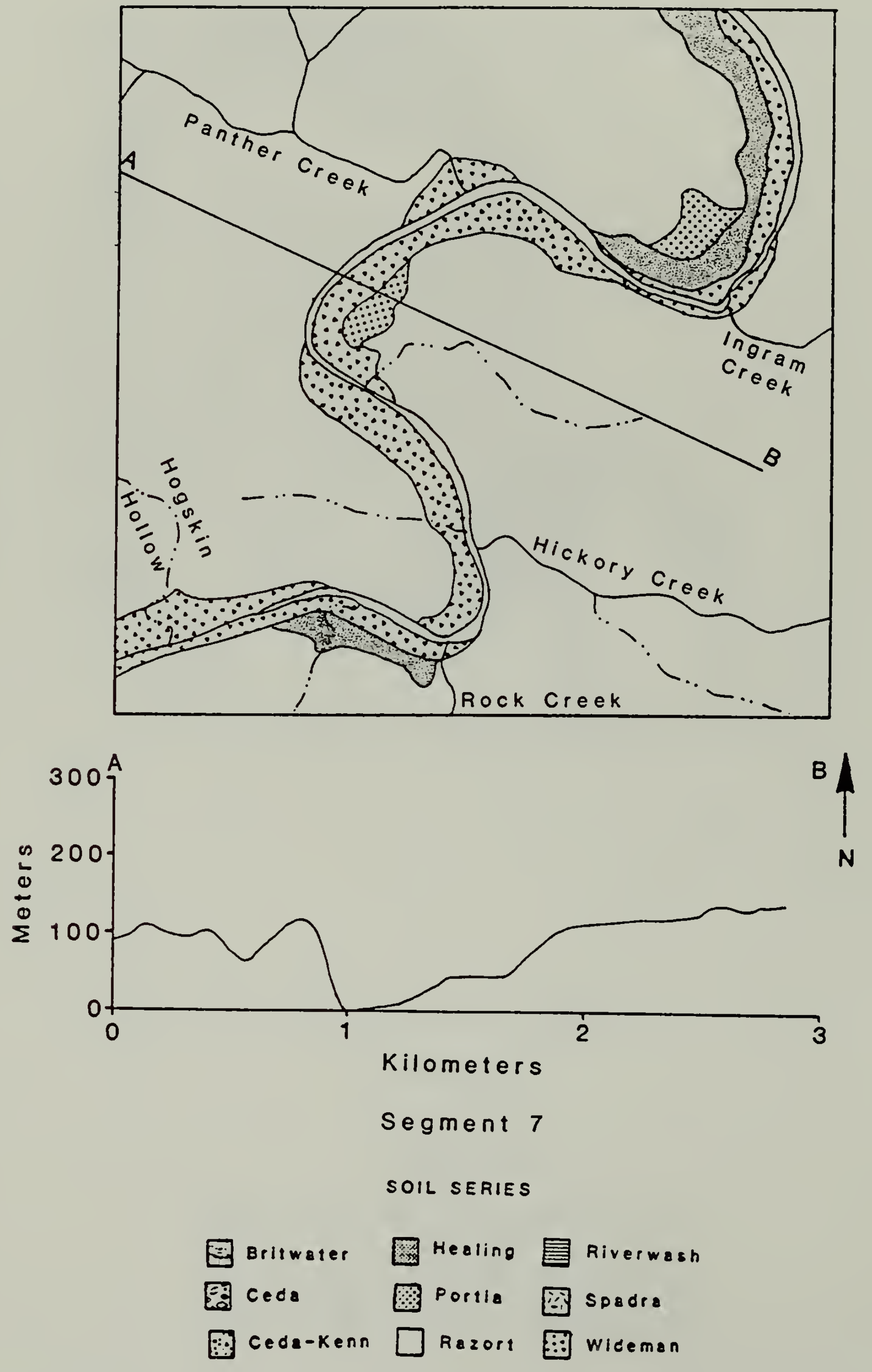


Figure 4.17. Soil Map and topographic cross section along a select area of the Buffalo River in segment 7 (Ward and McCright, 1983, sheets 57 and 61).

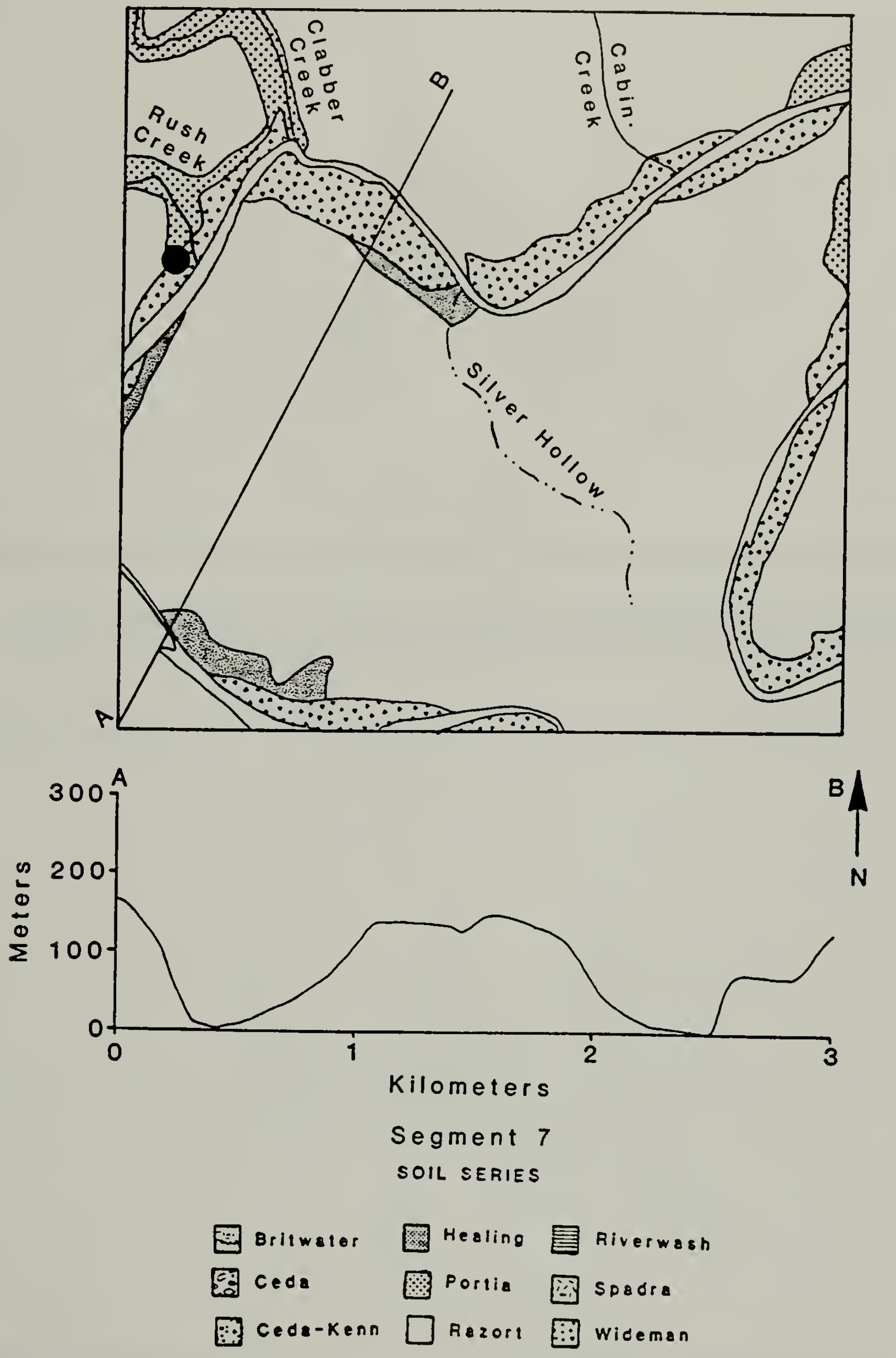


Figure 4.18. Soil Map and topographic cross section along a select area of the Buffalo River in segment 7 (Ward and McCright, 1983, sheets 51 and 57). Dot is the Rush Site (3MR80) near Rush, Arkansas.

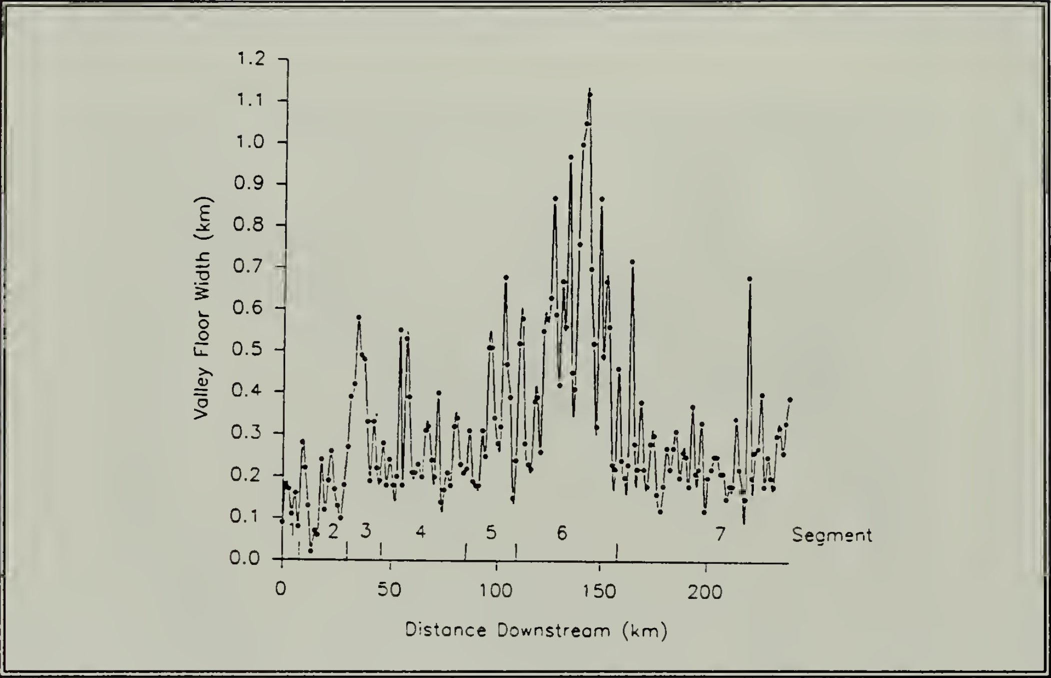


Figure 4.19. Width of valley floor (km) of the Buffalo River every 1.5 km distance downstream. Stream segments are shown along the lower portion of the plot.

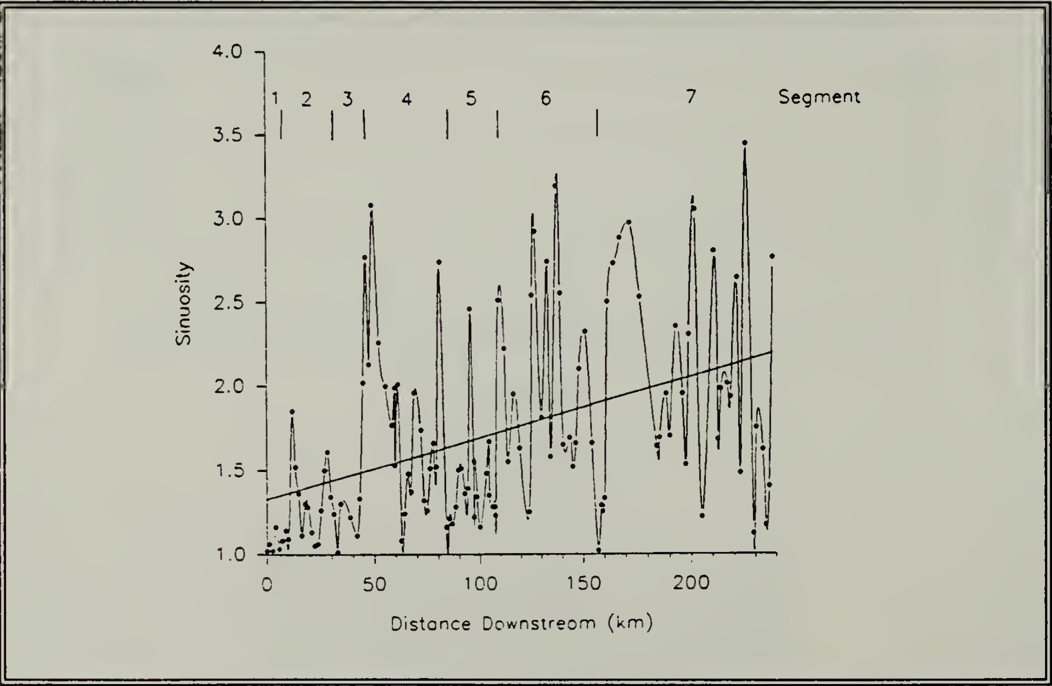


Figure 4.20. Sinuosity of the Buffalo River at 1.5 km intervals from river kilometer 0 to 34 where there are no meanders and along every meander downstream from river kilometer 34. Position of stream segments are shown along the upper portion of the plot.

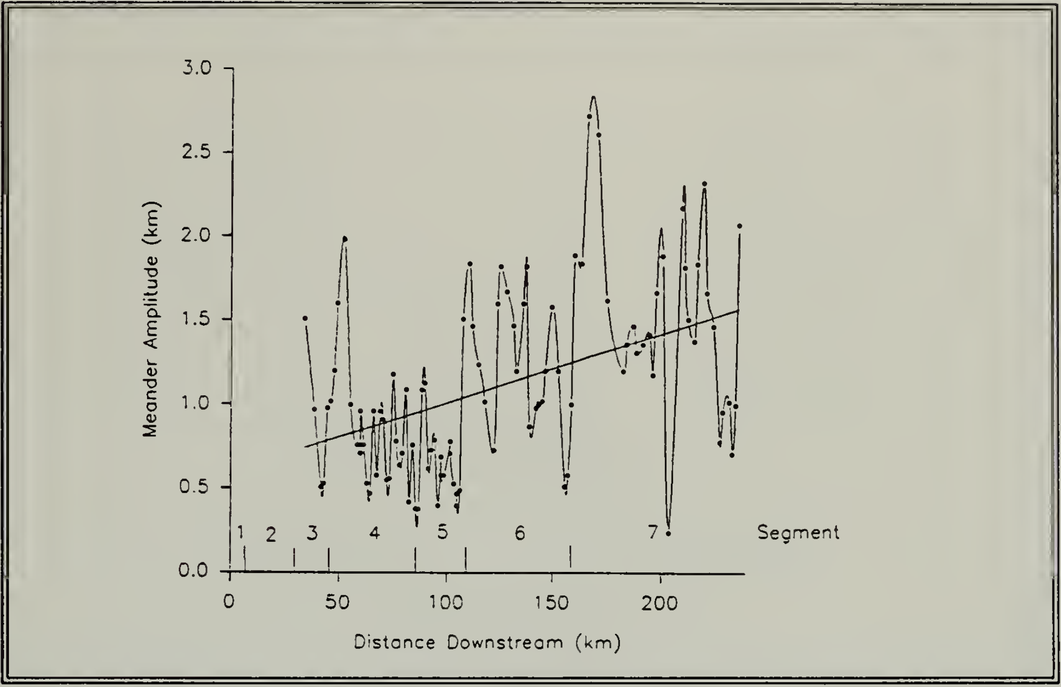


Figure 4.21. Amplitude of meanders along the Buffalo River, from river kilometer 34 to the confluence with the White River. Position of stream segments are shown along the lower portion of the plot.

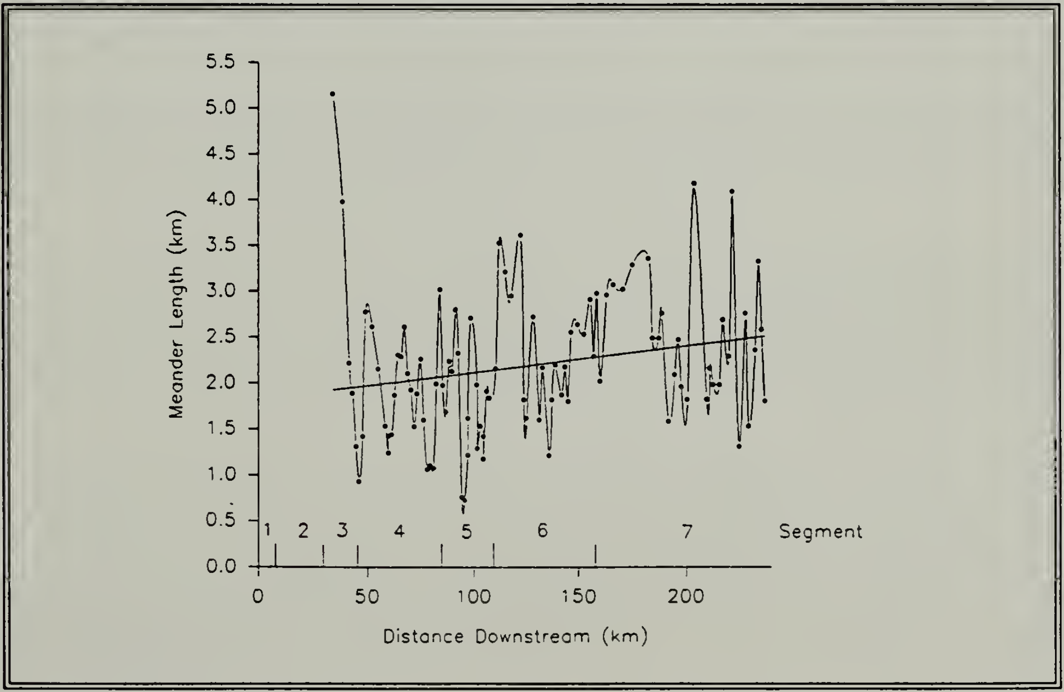


Figure 4.22. Wave length of meanders along the Buffalo River, from river kilometer 34 to the confluence with the White River. Position of stream segments are shown along the lower portion of the plot.

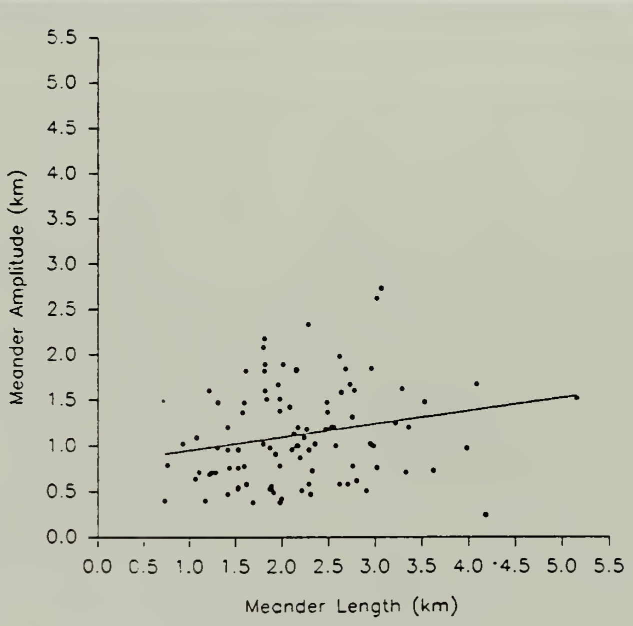


Figure 4.23. Plot of meander amplitude against meander wave length of the Buffalo River meanders.

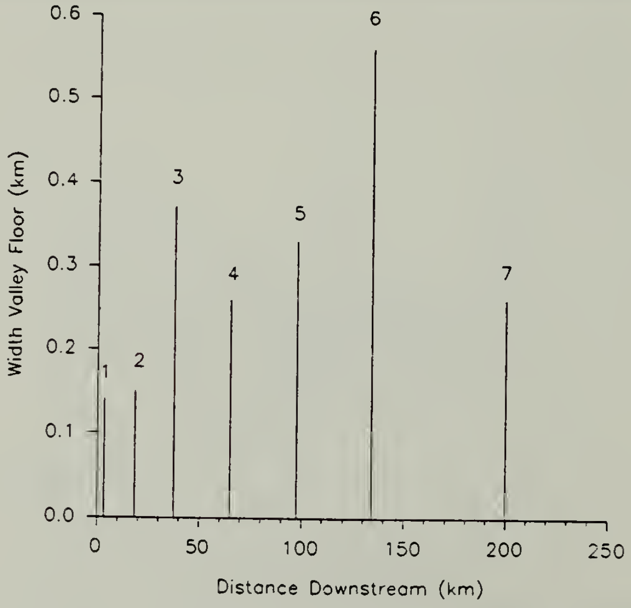


Figure 4.24. Mean valley floor width (km) for each segment of the Buffalo River.

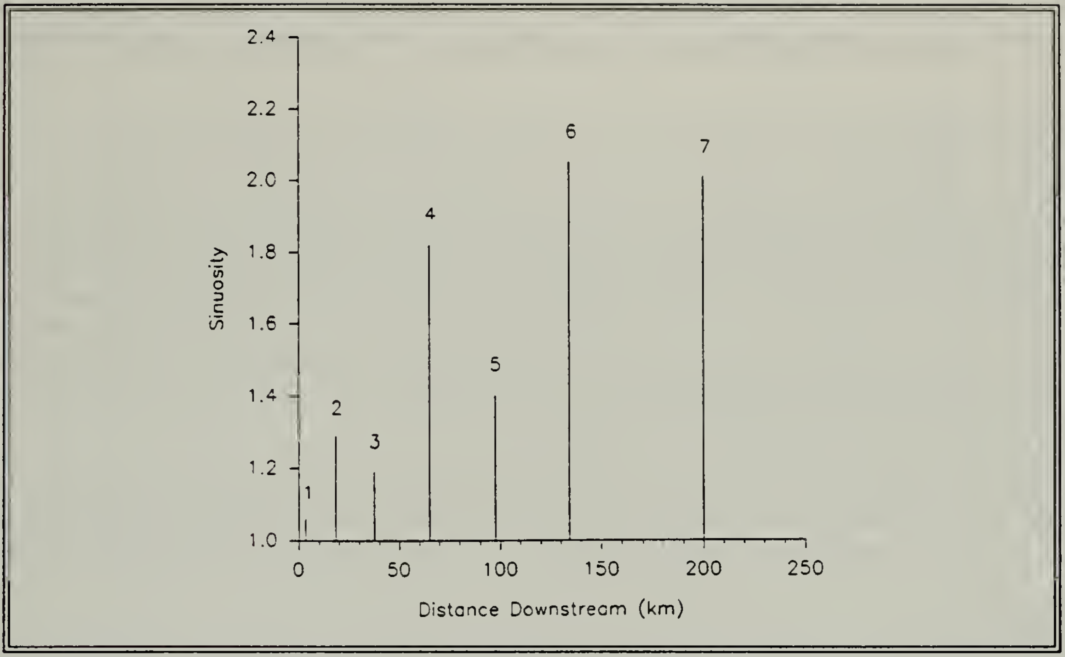


Figure 4.25. Mean sinuosity for each segment of the Buffalo River.

River are eroding Pennsylvanian sandstone and shale of the Bloyd and Hale Formations and Mississippian shale and cherty limestone of the Pitkin, Fayetteville, and Boone Formations (Figure 4.3) (Haley et al. 1976).

The valley within this segment is only slightly sinuous and not especially steep along most of the segment (Figure 4.9). Relief between the plateau surfaces and the valley floor is considerably greater in this segment than in Segment 1 (Figure 4.8). A bluff 104 m (340 feet) high is present (Figure 4.9). Along most of the segment the lower valley walls are not extremely steep, except where the stream erodes through a more resistant sandstone unit. In Segment 2 the valley floor is narrow (Figures 4.11, 4.19, and 4.24). Along most of this segment the valley floor is almost as narrow as that of Segment 1 and includes only the stream channel and a narrow floodplain. Where the floor is slightly wider, one low narrow terrace is present.

Along most of this segment the channel gradient is steep (Figure 4.7) and the channel pattern is straight (Figures 4.20 and 4.25). The steep gradient with a high degree of variability is typical of the headwater regions of streams. The Buffalo River has a low degree of sinuosity, except where the river flows between the elevations of 1500 and 1600 feet (457 and 488 m) between river kilometers 10 and 15 (6.2 to 9.3 miles). Here meanders are incised into the bedrock causing the valley to be narrower and steeper bluffs to be present (Figure 4.9).

Sediment underlying the narrow floodplain is probably thin along most of this segment. Generally the alluvium is coarse, poorly rounded channel gravel with minor amounts of fine-grained overbank deposits (Fowlkes et al. 1988). The soils mapped in the floodplain are entisols, alfisols, and ultisols (Figure 4.11) (Fowlkes et al. 1988). An entisol (Ceda Soil Series) is developed in stoney alluvium. Alfisols (Kenn and Razort Soil Series) weakly developed in sandy alluvium over channel gravel and an ultisol (Spadra Soil Series) developed in thicker sandy alluvium over channel gravel are mapped on both the floodplain and terraces. In addition there are numerous soils developed in bedrock.

The chance for preservation of archeological sites is limited in geographic extent in Segment 2. Most of the floodplain is narrow and is underlain by gravelly alluvium with Ceda and Kenn Soils developed in it. On these surfaces any sites that are present are probably relatively young surface sites because the sediment and land surfaces are probably late Holocene. Where the floodplain is wider, the fine-grained overbank deposits are thicker with better developed soils (Razort Soil) and the chance for buried archeological sites is increased. These surfaces may be late to mid Holocene in age. A low terrace with a Spadra Soil developed in it is preserved at a few locations. These surfaces may be mid Holocene and the possibility of buried archeological sites is greater.

SEGMENT 3

The third segment of the Buffalo River flows away from the base of the Boston Mountain Escarpment, across a reentrant of the Springfield Plateau (Figure 4.2). It extends from river kilometer 30 to kilometer 45, where the channel sinuosity increases (Figures 4.20 and 4.25) and the floodplain becomes narrower (Figures 4.19 and 4.24). There are some small, ephemeral tributaries, but more of the tributaries are large, perennial streams such as Smith Creek, Beech Creek, Moore Creek, Arrington Creek, Whiteley Creek, Clark Creek, Ponca Creek, and Leatherwood Creek. Bedrock along the channel of the Buffalo River and its tributaries is cherty limestone of the Mississippian Boone Formation and sandstone, limestone, and dolomite of the Ordovician St. Peter Sandstone and Everton Formations (Figure 4.3) (Haley et al. 1976).

Similar to Segments 1 and 2, the valley within this segment is not sinuous but unlike the upstream segments the walls are relatively steep (Figure 4.12). Both the relief between the upland plateau surfaces and the valley floor is greater (Figure 4.8) and the lower valley walls are steeper (Figure 4.9) than that in Segments 1 and 2.

The channel has an intermediate gradient and is straight in this segment. Compared to upstream segments, both the gradient and its variability are less in Segment 3 (Figure 4.7). Despite the wide floodplain across which the Buffalo River can meander, it maintains a lower sinuosity than every other river segment except the most upstream segment (1) (Figures 4.20 and 4.25). Side-channel bars are preserved at only one location.

Along most of this segment the valley floor is considerably wider than that of Segments 1 and 2 upstream and Segment 4 downstream (Figures 4.19 and 4.24). Though the valley floor is wide, its entire width is comprised of floodplain along nearly all of its length. A low, broad terrace is only preserved at two locations.

Sediment underlying the relatively wide floodplain in Segment 3 is probably thicker than that found in Segments 1 and 2. It extends to a depth in excess of 1.5 m (Guccione 1989a). Beneath the younger portions of the floodplain the alluvium is coarse, poorly rounded channel gravel with minor amounts of fine-grained overbank deposits (Fowlkes et al. 1988). Overbank deposits are relatively thin.

Similar soils are mapped on the floodplain and terrace (Figure 4.12) (Fowlkes et al. 1988). The soils mapped in the floodplain of Segment 3 are entisols developed in stoney alluvium (Ceda Soil Series) and in sand (Wideman Soil Series). Where the floodplain surface is slightly older, sandy-textured overbank deposits have accumulated on top of the channel gravel deposits. Weakly developed alfisols (Razort Soil Series) form in this sandy alluvium. In one location where the overbank sediment is finer textured than other soils along this segment, a moderately developed ultisol (Leadvale Soil Series) developed in clayey and silty alluvium. Though the Leadvale Soil is supposed to be developed in bedrock (Fowlkes et al. 1988), the geomorphology is strongly suggestive of fine-textured alluvium. The Razort Soil Series is mapped on the low terraces present in this segment as well as on the floodplain, suggesting that the terrace surface is relatively young.

The chance for preservation of archeological sites in Buffalo River Segment 3 is extensive (Spears et al. 1989). The floodplain is wide and continuous along this section of the Buffalo River (Figure 4.12). Where it is underlain by gravelly alluvium (Ceda Soil Series), the chance of finding an archeological site is small, but if one is present it will probably be late Holocene. However, where the floodplain surface is underlain by sandy or silty and clayey alluvium (Razort, Wideman, and Leadvale Soil Series), surface and buried archeological sites are likely (such as Luallen Site, 3NW662). On these floodplain surfaces any sites that are present are probably late to mid Holocene because the sediment and the land surface are relatively young. The one low terrace in this segment of the Buffalo River and terraces of the tributaries are older than the surrounding floodplain and have good potential for surface and buried sites (for example Sattler Site, 3NW663). This surface may be mid Holocene and therefore mid to late Holocene sites could be buried or on the surface of the terrace.

SEGMENT 4

The fourth segment of the Buffalo River also flows across a reentrant of the Springfield Plateau (Figure 4.2). It extends from river kilometer 45 to kilometer 85, where the sinuosity decreases (Figures 4.20 and 4.25) and the valley floor becomes wider (Figures 4.19 and 4.24). There are many small, ephemeral tributaries, but also a number of tributaries that are large, perennial streams such as Steel Creek, Sneeds Creek, Indian Creek, Bear Creek, Shop Creek, Cecil and Cove Creeks, an unnamed creek, Hoskin Creek, and Mill Creek. Bedrock along these channels and that of the Buffalo River is Ordovician sandstone, limestone, and dolomite of the St. Peter and Everton Formations (Figure 4.3) (Haley et al., 1976).

The valley within segment 4 is more sinuous than any of the upstream segments (Figures 4.20 and 4.25) and the steepness of the valley walls is greater than that of all the segments upstream. In the downstream portion of this segment meanders have been entrenched into an "inner gorge". Though the maximum relief between the upland plateau surfaces and the valley floor is about the same in this segment as it is in Segment 3 (Figure 4.8), the lower valley walls are considerably steeper than in Segment 3 (Figure 4.9). Downstream, near the confluence with the Little Buffalo River, the divides are not as high and the bluffs are not as steep.

In this segment the Buffalo River has a relatively low gradient (Figure 4.7) and is meandering (Figures 4.20 and 4.25). As the gradient decreases downstream, so does the variability of the gradient. Meanders are somewhat complex with some second-order meanders superimposed on first-order meanders forms. The meanders are more deeply incised in the upstream portion of this segment than in the downstream portion. Side-channel bars are preserved at a number of localities, mostly along straighter sections of the stream.

Along most of this segment the valley floor is slightly narrower than that of Segment 3 upstream and Segment 5 downstream (Figures 4.19 and 4.24). However the valley is wide enough to include terraces, and multiple terraces are preserved along much of this segment. The most complete terrace sequence is preserved within the meander bends. Within 24 m (80 feet) of the valley floor two terraces are readily identified at many localities and a third terrace is located near Pruitt. In the downstream portion of this stream segment, between Erbie and Pruitt, high-level terrace remnants may be present 61 m (200 feet) above the floodplain within meander bends. Downstream sections of Cecil and Cove Creeks near Erbie may occupy an abandoned meander bend of the Buffalo River at this high level (Figure 4.13).

Sediment underlying the relatively wide floodplain in segment 4 extends to a minimum depth of 2.5 m (Guccione 1988). Beneath the younger portions of the floodplain the alluvium is coarse, poorly rounded channel gravel with minor amounts of fine-grained overbank deposits or sand. In the older portions of the floodplain and on the terraces relatively thick sandy sediment overlies channel gravel (Fowlkes et al. 1988).

The soils mapped on the floodplain surfaces are entisols and alfisols (Figures 4.13 and 4.14) (Fowlkes et al. 1988). On the lower floodplain surfaces the Ceda Soil Series is developed in stoney alluvium and the Wideman Soil Series is developed in sand. Where the floodplain surface is slightly higher and older, finer-textured overbank deposits have accumulated on top of the channel gravel deposits. Weakly developed alfisols (Razort Soil Series) form in the sandy alluvium and moderately developed alfisols (Britwater Soil Series) form in the more clayey textured alluvium.

Alfisols have been mapped on the terraces (Figures 4.13 and 4.14) (Fowlkes et al. 1988). The Razort and Britwater soils are mapped both on the low terraces and on the floodplain, suggesting that the terrace surface is relatively young. The well-developed alfisol, the Britwater Soil Series is mapped at one location on a broad flood-plain surface. Though this soil is supposed to be developed on old alluvial sediment, the clayey texture is probably more responsible for its degree of development than its age. In this stream segment the Britwater soil is mapped on a very broad floodplain and terrace. The greater distance from the channel causes the finer texture of the overbank sediment and the greater apparent development. Portia soils have been mapped on some of the higher landforms that have a geomorphic form of a terrace. This soil series is reported to be developed on residuum or colluvium. It is very possible it has also developed on patches of alluvium preserved on old dissected terraces.

The chance for preservation of archeological sites in Buffalo River Segment 4 is extensive. The floodplain is wide and nearly continuous along this section of the Buffalo River (Figures 4.13 and 4.14). Where it is underlain by gravelly alluvium (Ceda Soil Series), the chance of finding an archeological site is small, but if one is present it will probably be late Holocene. However, where the floodplain surface is underlain by sandy or silty and clayey alluvium (Razort, Wideman, and Britwater Soil Series), surface and buried archeological sites are likely (Webb Branch Site, 3NW206) (Lafferty et al. 1988). On these floodplain surfaces any sites that are present are relatively young because the sediments and land surfaces are probably late to mid Holocene. The low terrace, approximately 4 m (12 feet) above the adjacent floodplain, also has good potential for surface and buried sites (such as Elk Track Site, 3NW205) (Lafferty et al. 1988). This surface may be mid Holocene and therefore early to mid Holocene sites could be buried if sedimentation occurred through this entire time period and mid to late Holocene sites may be present on the surface of the terrace. Higher terraces and bedrock benchs are probably Pleistocene or older. These terraces may have archeological sites at the surface (Dry Ford Site, 3NW507) (Lafferty et al. 1988).

SEGMENT 5

The fifth segment of the Buffalo River flows across the Springfield Plateau (Figure 4.2). It extends from river kilometer 85 to kilometer 110, where the sinuosity is increased (Figures 4.20 and 4.25) and the valley floor becomes considerably wider (Figures 4.19 and 4.24). There are numerous small, ephemeral tributaries, but only a few tributaries are large, perennial streams such as Boomer Hollow, Little Buffalo River, Wells Creek, Bear Cave Hollow, an unnamed spring, and Big Creek. Of these, the Little Buffalo River and Big Creek are large tributaries with relatively broad valley floors. These streams have lowered the local water table, reducing the number of permanent streams in the area. Bedrock along these channels and that of the Buffalo River is Ordovician sandstone, limestone, and dolomite of the St. Peter and Everton Formations (Haley et al. 1976).

The valley within Segment 5 is not particularly sinuous (Figures 4.20 and 4.25) nor are the valley walls particularly steep (Figure 4.15 and 4.9). Maximum relief between the upland plateau surfaces and the valley floor is about the same in this segment as it is in Segments 3 and 4 upstream because tongues and outliers of the Boston Mountain Plateau are present in the area (Figure 4.8).

In Segment 5, the Buffalo River has a low gradient (Figure 4.7) and a straight channel pattern (Figure 4.25). The low gradient has little variability. The meanders that are present have a simple morphology without second-order meanders. A few side-channel bars and one gravel point bar are present.

Within this segment the valley floor is slightly wider than that of Segment 4 upstream but narrower than Segment 6 downstream (Figures 4.19 and 4.24). At least two terraces are preserved along much of this segment. Within 24 m (80 feet) above the valley floor two terraces are readily identified at many localities. On the inside of the meanders the highest and widest terraces are preserved. A terrace 12 m (40 feet) above the modern floodplain is well preserved just downstream of the confluence with the Little Buffalo River (Figure 4.15). A half-mile section of the Buffalo River was abandoned when the Little Buffalo River eroded through a divide separating the two rivers (Lost Hill). The Buffalo River abandoned its course to the east and flowed down the western channel of the Little Buffalo River. Unlike Segment 4, terraces more than 24 m (80 feet) above the floodplain were not noted in this segment of the Buffalo River.

Beneath younger portions of the floodplain the alluvium is coarse, channel gravel with minor amounts of fine-grained overbank deposits or sand. In the older portions of the floodplain and on the terraces relatively thick sandy, silty, and clayey sediment overlies channel gravel (Fowlkes et al. 1988).

The soils mapped on the floodplain surfaces are entisols and alfisols (Figure 4.15) (Fowlkes et al. 1988). On the lower floodplain surfaces the Ceda Soil Series is developed in stoney alluvium. Where the floodplain surface is slightly higher and older, finer-textured overbank deposits have accumulated on top of the channel gravel deposits. Weakly developed alfisols (Razort Soil Series) form in the sandy alluvium.

Alfisols and ultisols are mapped on the terraces (Figure 4.15) (Fowlkes et al. 1988). The Razort Soil (alfisol) is mapped on the floodplain as well as on low and high terraces and the abandoned channel at Lost Hill. If this moderately developed soil is indicative of a young surface, it suggests that these terrace surfaces may be relatively young. and that the Buffalo River has eroded its channel 12 m (40 feet) during the Holocene. This rate of degradation seems excessive. The well-developed alfisol, the Britwater Soil Series is mapped on a terrace approximately 25 m (40 feet) above the adjacent floodplain. This surface may be equivalent in age to the abandoned channel east of Lost Hill and the difference in the soil and degree of development is probably due to the finer texture of the parent material. The Portia Soil (alfisol) is mapped on sandy and gravelly surfaces that seem to be terraces 12 to 24 m (40 to 80 feet) above the floodplain. Finally the Spadra Soil (ultisol) is mapped on terrace surfaces intermediate in elevation between surfaces mapped as Razort and Britwater.

The chance for preservation of archeological sites in Buffalo River Segment 5 is excellent. The floodplain is wide and nearly continuous along this section of the Buffalo River. Where it is underlain by gravelly alluvium (Ceda Soil Series), the chance of finding an archeological site is small, but if one is present it will probably be late Holocene. However, where the floodplain surface is underlain by sandy alluvium (Razort Soil Series), surface and buried archeological sites are likely. On these floodplain surfaces any sites that are present are probably relatively young because the sediments and land surfaces are probably late to mid Holocene. Low terraces also have a good potential for surface and buried sites. These surfaces may be mid Holocene and therefore early to mid Holocene sites could be buried if sedimentation occurred through this entire time period. Mid to late Holocene sites may be present on the surface of the terrace. Terraces 12 m (40 feet) and more are probably Pleistocene or older, despite the presence of the Razort Soil on these surfaces. These terraces may have archeological sites at the surface.

SEGMENT 6

The sixth segment of the Buffalo River flows across the Springfield Plateau (Figure 4.2). It extends from river kilometer 110 to kilometer 158, where the valley floor becomes considerably narrower (Figures 4.19 and 4.24). There are numerous small, ephemeral tributaries, but there are only a few tributaries that are perennial streams such as Davis Creek, Mill Branch, Cave Creek, Cane Branch, Richland Creek, Jamison Creek, Calf Creek, and Mill Creek. Of these, Cave Creek, Richland Creek, and Calf Creek are large tributaries with relatively broad valley bottoms. These streams have lowered the local water table, reducing the number of permanent streams in the area. Bedrock along these channels and that of the Buffalo River is Ordovician sandstone, limestone, and dolomite of the St. Peter and Everton Formations in the upstream portion of the segment. Mississippian cherty limestone of the Boone Formation occurs through out most of the segment (Haley et al. 1976).

The valley walls of Segment 6 are moderately sinuous but are not particularly steep. Maximum relief between the upland plateau surfaces and the valley floor is about the same in this segment as it is in Segments 3, 4, and 5 upstream (Figure 4.8) because tongues of the Boston Mountain Plateau are present just to the south of the area. The lower valley walls are not particularly steep (Figure 4.9).

In Segment 6, the Buffalo River has a very low gradient (Figure 4.7) and a meandering channel pattern (Figures 4.20 and 4.25). The low gradient has little variability, except at the most upstream portion of the segment. Meanders that are present have a simple morphology without second order meanders. Gravel point bars are common.

The valley floor is wider in Segment 6 than any other segment of the Buffalo River and includes the floodplain and multiple terraces. The floodplain is nearly continuous and relatively wide (Figure 4.16). There are at least two terraces preserved along much of this segment up to an elevation of 24 m (80 feet) above the floodplain. Similar to segment 4 upstream, high-level terraces or bedrock benches more than 24 m (80 feet) above the floodplain were noted within most of the meanders.

Beneath younger portions of the floodplain the alluvium is coarse, channel gravel with minor amounts of fine-grained overbank deposits or sand. In the older portions of the floodplain and on the terraces relatively thick sandy, silty, or clayey sediment overlies channel gravel (Fowlkes et al. 1988; Fowlkes et al. in press). The soils mapped on the floodplain surfaces are entisols and alfisols (Figure 4.16) (Fowlkes et al. 1988; Fowlkes et al. in press). On the lower floodplain surfaces entisols (Wideman Soil Series) are developed in sandy alluvium. Where the floodplain surface is slightly higher and older, weakly developed alfisols such as the Razort Soil Series form in the loamy alluvium close to the channel and the Healing Soil Series forms in silty alluvium at a greater distance from the channel.

Alfisols are mapped on the terraces (Figure 4.16) (Fowlkes et al. 1988). The Razort Soil Series (alfisol) is mapped on the floodplain as well as on low terraces. If this moderately developed soil is indicative of a young surface, it suggests that these terrace surfaces may be relatively young. In the upstream portion of this segment the Portia Soil Series (alfisol) is mapped on sandy and gravelly surfaces that seem to be terraces 12 m (40 feet) above the floodplain. In the downstream portion of Segment 6 limestone soils, such as the Peridge (alfisol) and Noark Soil Series (ultisol) are present in landscapes that appear to be high terraces 12 to 30 m (40 to 100 feet). If these benches are the eroded remnants of terraces, any alluvium that is preserved is apparently thin.

The chance for preservation of archeological sites in Buffalo River Segment 6 is probably the best of any segment along the Buffalo River. Both the floodplain and the terraces are the widest of any segment of the Buffalo River and are nearly continuous along this section of the Buffalo River. Surface and buried sites potentially could be found on the floodplain and the lower terrace(s). The low terrace surfaces may be mid Holocene. Therefore, early to mid Holocene sites could be buried and mid to late Holocene sites may be present on the surface of the terraces. Terraces 12 m (40 feet) and more are probably Pleistocene or older. These terraces may have archeological sites at the surface.

SEGMENT 7

The seventh segment of the Buffalo River erodes into the Springfield Plateau to form a deep reentrant of the Eureka Springs Escarpment and flows beyond the escarpment across the Salem Plateau (Figure 4.2). It extends from river kilometer 158 to kilometer 241, at the confluence with the White River. Along this segment there are numerous small, ephemeral tributaries, and some tributaries that are large, perennial streams such as Bear Creek, Brush Creek, Tomahawk Creek, Spring Creek, Water Creek, Rock Creek, Hickory Creek, Panther Creek, Ingram Creek, Rush Creek, Clabber Creek, Cabin Creek, Boat Creek, Brush Creek, Big Creek, Middle Creek, Leatherwood Creek, Cow Creek, and Stewart Creek. Of these, only Bear Creek and Big Creek are large tributaries with a relatively broad valley floors. Bedrock along these channels and that of the Buffalo River is Silurian limestone of the Lafferty, St. Clair, and Brassfield Formations and Ordovician shale, sandstone, limestone and dolomite of the Cason, Fernvale, Kimmswick, Plattin, and Joachim Formations, along the very upstream portion of the segment. Sandstone, limestone, and dolomite of the Ordovician St. Peter and Everton Formations occur along most of the segment (Haley et al. 1976).

The valley within Segment 7 is quite sinuous (Figures 4.20 and 4.25) and the valley walls are very steep (Figures 4.17 and 4.18). At the head of the escarpment the maximum relief between the upland plateau surfaces and the valley floor is only slightly less than that in Segments 3, 4, 5, and 6 upstream (Figure 4.8). Downstream, at greater distances for the Boston Mountain Plateau, the relief rapidly decreases to as little as 146 m. Though the total relief is relatively low, the lower valley walls are very steep and bluffs are common (Figures 4.9, 4.17, and 4.18).

In Segment 7, the Buffalo River has a very low gradient (Figure 4.7) and very high sinuosity (Figures 4.20 and 4.25). The low gradient has little variability. Meanders that are present are first-order meanders but some have very large wave amplitudes compared to their wave length and many are asymmetric, pointing in the upstream direction. Gravel and sand point bars are very common.

Within this segment the valley floor is quite narrow (Figures 4.19 and 4.24). It includes the floodplain and multiple terraces locally. The floodplain is almost entirely a gravel point bar at many locations. Terraces are best developed on the inside of meanders. Two or three terraces are present up to an elevation of 24 m (80 feet) above the floodplain at a number of locations along much of this segment. Commonly the lowest terrace is noted at 12 m (40 feet) above the floodplain surface. Unlike segments 4 and 6 upstream, a high-level terrace or bedrock bench more than 24 m (80 feet) above the floodplain was only noted at one locality.

Beneath younger portions of the floodplain the alluvium is coarse, channel sand and gravel with minor amounts of fine-grained overbank deposits or sand. In the older portions of the floodplain and on the terraces relatively thick sandy or silty sediment overlies channel gravel (Ward and McCright 1983; Fowlkes et al. in press).

The soils mapped on the floodplain surfaces are entisols (Figure 4.17 and 4.18) (Ward and McCright 1983; Fowlkes et al. in press). The Wideman Soil Series is developed in sandy alluvium. Alfisols and mollisols are mapped on the terraces (Figure 4.16 and 4.17). In Marion County the Razort Soil Series (alfisol) is mapped on low terraces where the sediment is sandy and Britwater Soil Series (alfisol) forms where the alluvium is loamy (Ward and McCright 1983). In Searcy County the Healing Soil Series (mollisol) is mapped on the low terraces where the alluvium is silty (Fowlkes et al. in press). Alfisols are present on the highest terraces or along valley edges (Ward and McCright 1983 and Fowlkes et al. in press). The Portia Soil Series (alfisol) is mapped on sandy and gravelly surfaces that seem to be terraces 12 m (40 feet) above the floodplain.

The preservation of archeological sites in Buffalo River Segment 7 is probably different than it is along other sections of the river, such as segments 3, 5, and 6. Along Segment 7, the floodplain and terraces are narrow. Because of the narrow valley, flooding is higher and floodplain sedimentation includes thicker, more sandy and better sorted sediment at higher elevations above the floodplain. This is in contrast to the stream segments where wider valleys allows flood waters to spread laterally, decrease in velocity, and deposit thinner, finer sediment that is more poorly sorted. Thus in Segment 7, the area for archeological sites is more limited than that upstream, but the possibility that the sites are stratified and separated by layers of sediment is greater such as the Dirst Site (3MR80) (Sabo et al. 1990). Though it will be more difficult to identify archeological sites, their preservation and potential for providing useful information on shorter time spans is greater. Similar to the other segments of the Buffalo River, only surface sites would be found on the upper terraces.

SUMMARY AND CONCLUSIONS

Geomorphology

On the basis of topographic and soils maps, a first approximation of the valley floor morphology, sediments, and age of the landforms using soil development can be made. Using these data, the Buffalo River has been divided into seven segments based on the valley floor width and channel pattern. Similar to many rivers, the gradient value and variability decreases, the valley floor becomes wider, and the sinuosity increases in the downstream direction. Despite these general trends there is a great deal of variability on a local scale and on an intermediate scale. Divisions of the river into the seven segments were made on the basis of variability at the intermediate scale.

Segments 1 and 2 are in the headwaters region and are characterized by a steep and highly variable gradient, a narrow valley floor, and a straight channel pattern. The floodplain is discontinuous and terraces are present in Segment 2 but not in Segment 1. Sediment underlying the floodplain and narrow discontinuous terrace is dominantly loam, sand, and gravel.

Segment 3 also has a straight channel but, unlike Segments 1 and 2, this segment has an intermediate gradient and a wide valley floor with a nearly continuous floodplain. The valley floor is mostly comprised of floodplain because the river moves across its valley floor more rapidly than it incises and terraces are not commonly preserved, except along tributary creeks. Sediment underlying the floodplain is dominantly loam, sand, and gravel.

Segment 4 is the most upstream segment where the Buffalo River is dominantly meandering. Here the gradient is low with only moderate amounts of variability. Incision of the meanders has resulted in intermediate valley widths with a nearly continuous floodplain and multiple terrace preservation. Sediment underlying the floodplain is dominantly loam, sand, and gravel but areas of finer grained overbank deposits are also present and continue to be present in all downstream segments.

In Segment 5 the Buffalo River channel is straight, more similar to Segments 1 through 3. Though valley floor of Segment 5 is relatively wide and nearly continuous, similar to that of Segment 3, the valley floor of Segment 5 includes both the floodplain and multiple terraces. Apparently the channel does not migrate across the valley floor of Segment 5 as rapidly as in Segment 3. Sediment underlying the floodplain is dominantly loam, sand, and gravel but areas of finer grained overbank deposits are also present.

In Segments 6 and 7 the Buffalo River is meandering with a high degree of sinuosity. The valley floor is continuous and multiple terraces are preserved both where the valley is quite wide in segment 6 or quite narrow as in Segment 7. Similar to Segments 4 and 5 the channel does not migrate across its valley floor as rapidly as it incises its valley. In contrast to all the upstream segments, most of the surface alluvial deposits are sand-sized and finer in Segments 6 and 7.

Valley Incision

Map interpretation is useful for an initial study of the Buffalo River, but more complete interpretation of the ages of sediment and assessment of the archeological potential requires more detailed field studies. Five archeological sites on the valley floor have had detailed geomorphic and sedimentologic field analyses: the Luallen (3NW662) and Sattler Sites (3NW663) at Boxley, Arkansas in Segment 3 (Guccione 1989a), the Elk Track (3NW205) and Webb Branch Sites (3NW206) at Erbie, Arkansas (Guccione 1988) in Segment 4, and the Dirst Site (3MR80) at Rush, Arkansas (Guccione and Guendling 1990) in Segment 7. In addition the Dry Ford Site (3NW507) in Segment 4, a possible high terrace along the valley wall, has been studied (Guccione 1989b).

Integrating these studies provides a hypothesis concerning the timing and cause(s) of the most recent incision of the Buffalo River. Sediment and soil associated with the lowest terrace and floodplain along the Buffalo River have been dated using radiocarbon dates and diagnostic archeological artifacts at sites listed above. These data can be used to determine if abandonment of the lowest terrace and incision of the modern floodplain level is contemporaneous or time transgressive along the river.

At the three terrace sites studied in detail (Sattler Site at Boxley, Elk Track Site at Erbie, and Dirst Site at Rush) some trends are evident. The valley floor and floodplain width become narrower (Figure 4.26), overbank sediment associated with the lowest terrace becomes thicker (Figure 4.27), the soils become more weakly developed, and the terrace surface becomes younger downstream (Figure 4.28). The validity of the trend in valley floor width can be tested using map analysis. The general applicability of other trends noted at these three sites will require integrating future field observations and cannot be adequately tested with only map analysis.

Width of the valley floor can be measured using the topographic maps, but measurement of floodplain and terrace width is more difficult. Figure 4.19 illustrates that the width of the valley floor measured on the maps is quite variable but there is a trend for the channel to become wider downstream from Segment 1 to Segment 6 and then to decrease in width from middle of Segment 6 to the confluence with the White River. Valley floor width is probably determined in part by bedrock along the lower valley walls. The widest segments of the river, Segments 3 and 6, occur where cherty limestone of the Boone Formation and the overlying Fayetteville Shale are present along the lower part of the valley walls. The narrower segments are either in the headwater regions (Segments 1 and 2) or have limestone, dolomite, and sandstone of the St. Peter and Everton Formations.

Though width of the valley floor can be measured using the 7 1/2 minute topographic quadrangle maps with 20 or 40 foot contour intervals, precise identification of terraces, their widths, and their elevations above the floodplain is impossible, especially for low terraces. The soil maps do provide some additional information on the division of the valley floor into floodplain and terraces because some soil series typically form on the floodplain and others typically form on terraces. However, the soil maps cannot be used in a strict sense to map terraces because the mapped soil series do not strictly conform to the landform. Using the soil maps, many exceptions to the general rule were noted. For instance, the Razort Soil is typically formed on floodplains (Ward and McCright 1983; Fowlkes et al. 1988), yet this soil series is also mapped in an abandoned valley that is 12 m (40 feet) above the modern floodplain (Figure 4.15).

In conclusion, the width of the valley floor along the Buffalo River does not generally decrease downstream and it is unlikely that widths of the floodplain and terraces also decrease downstream as originally hypothesized. The trend in width of the valley floor, the lowest terrace, and floodplain observed at the specific study sites is not a general trend for the river, but is an "accident" of the locations studied. Boxley is located in Segment 3 where the floodplain is typically wide and terraces are only present on the tributary valleys. Erbie is located in Segment 4 which typically has a narrow valley floor that includes terraces. At the sites studied the valley floor is wider than the mean valley floor width. Finally, Rush is located in Segment 7 which also has a mean narrow valley floor width similar to that in Segment 4 and includes multiple terraces. At this study site the valley floor is approximately the same width as the mean valley floor width.

The second generalization based on the three valley floor study areas, that overbank thickness associated with the lowest terrace increases downstream, is impossible to test using map analysis. At the three areas with field studies, aggregation of the overbank sediment increases from 0.95 m in Segment 3 near the headwaters to 2+ m in Segment 7, near the mouth of the Buffalo River (Figure 4.27). Additional field data is needed to assess if this trend is valid or is an "accident" of the location of the three study sites. In addition to changes in the thickness of sediment, changes in the volume of sediment should also be determined. For an equal volume of sediment deposited at a given area, narrow valleys would have a greater thickness of overbank sediment in contrast to a wide valley.

Finally, the third generalization, that the age of the terrace surface becomes younger downstream, is impossible to test using map analysis. First, it is difficult to identify the lowest terrace, 3 to 4 m (10 to 13 feet)

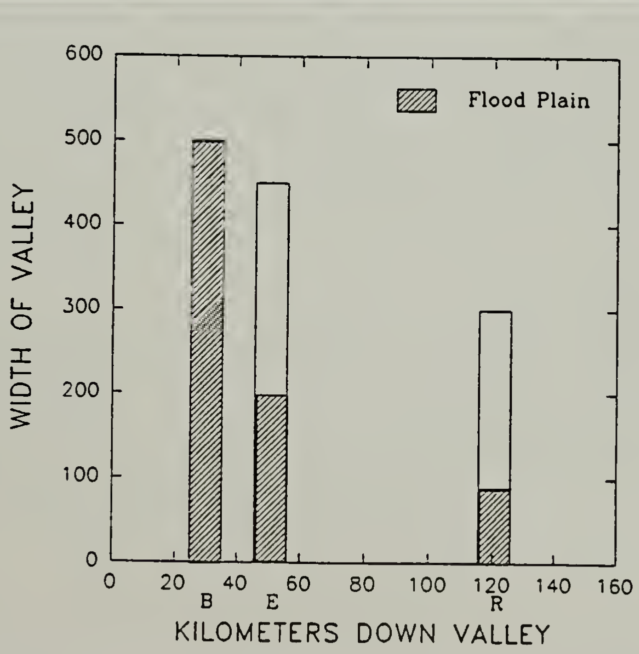


Figure 4.26. Width of the valley floor, the flood plain, and a low terrace of the Buffalo River at Boxley (B), Erbie (E), and Rush (R).

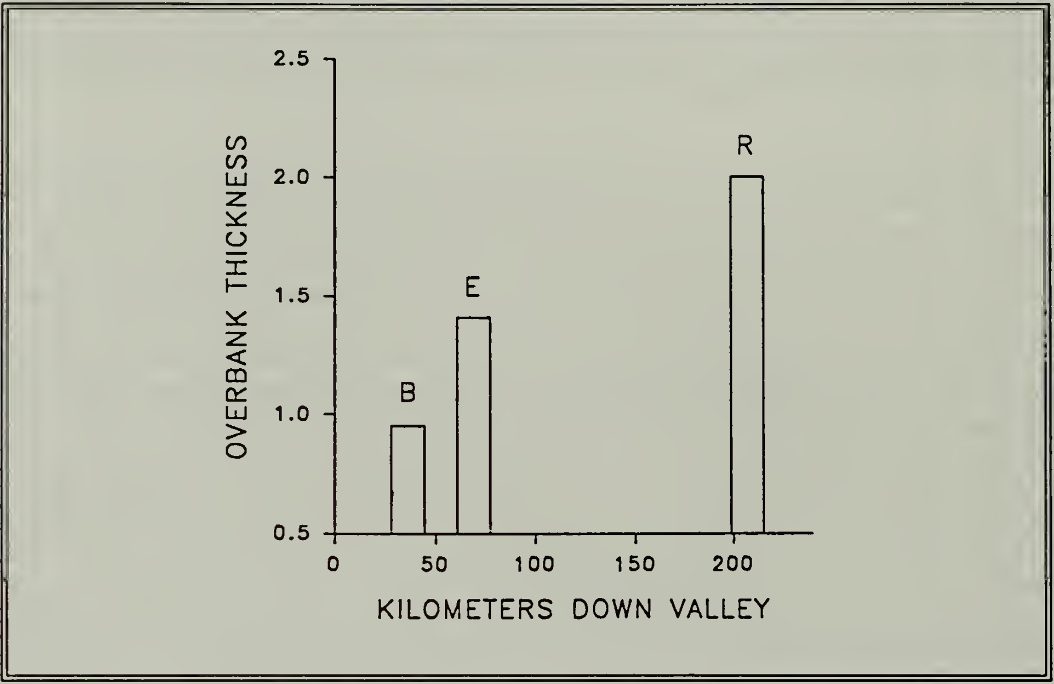


Figure 4.27. Thickness of overbank sediment that underlies the lowest terrace of the Buffalo River at Boxley (B), Erbie (E), and Rush (R).

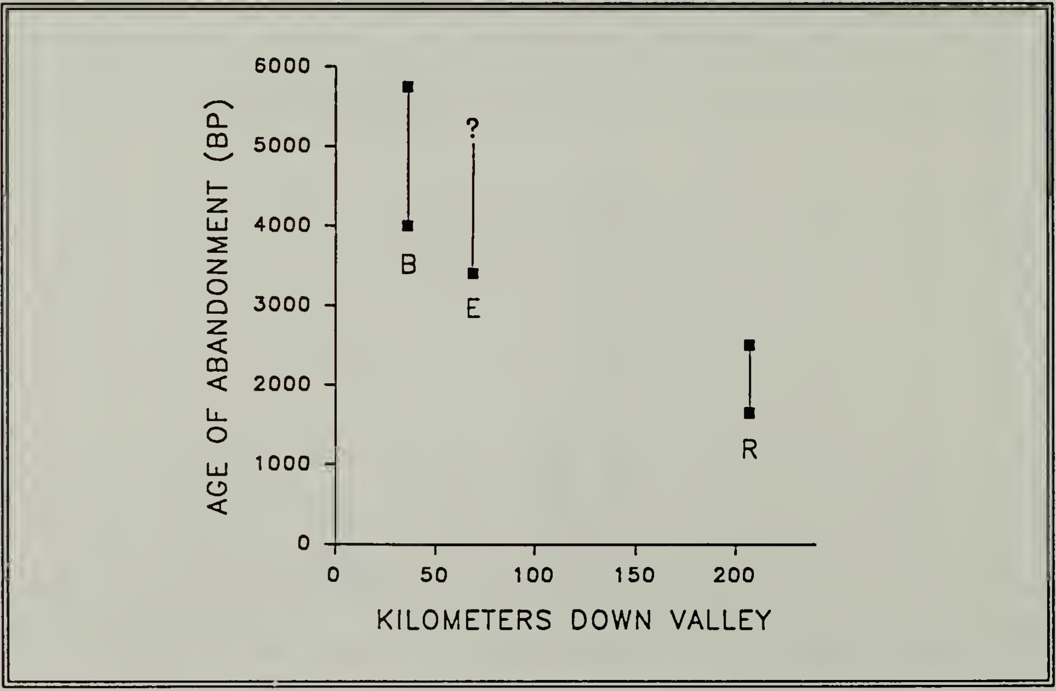


Figure 4.28. Age of abandonment of the lowest terrace and initiation of the modern flood plain of the Buffalo River at Boxley (B), Erbie (E), and Rush (R).

above the floodplain (Guccione 1988; 1989a; Guccione and Guendling 1990) using topographic maps with contour intervals of 6 m (20 feet) and 12 m (40 feet). Therefore it is difficult to identify the soil developed on terrace surfaces. Conversely, soil series are not restricted to single geomorphic surfaces and therefore it is difficult to identify the terraces using the soil maps.

Utilizing the field studies, the age of the lowest terrace surface does decrease downstream. This observation is on the basis of soil development and archeology. The degree of soil development decreases downstream. In Segment 3 an ultisol with an argillic horizon (Spadra Soil Series) is mapped on the lowest terrace of Moore Creek at its confluence with the Buffalo River. In Segment 4 an alfisol with an argillic horizon (Razort Soil Series) is mapped on the lowest terrace. Downstream is Segment 7, an entisol without a B horizon (Wideman Soil Series) is mapped on the low terrace. In a general sense ultisols are very mature soils that require the longest duration of weathering, alfisols are moderately mature soils that require an intermediate duration of weathering, and entisols are young soils that require the least degree of weathering.

The archeology supports the field observations on the distribution of soil development along the Buffalo River. The only evidence for initiation of sediment aggradation associated with the lowest terrace is at Rush, the downstream location. Sedimentation probably began 9,000 to 10,500 years ago because a Dalton Point and an Early Archaic Rice Lobed point were found in the buried soil immediately beneath this sediment (Guccione and Guendling 1990). It is unknown if this date for the initiation of sedimentation associated with the low terrace is applicable to other locations along the Buffalo River.

The apparent trend along the Buffalo River is a time-transgressive incision, with the oldest incision and abandonment of the terrace in the upstream section of the stream and the most recent incision and abandonment of the terrace in the downstream section of the stream. Abandonment of appreciable sedimentation on the terrace surface occurred subsequent to 5,750 +90 (Beta-26213) and 6,010 + 70 (Beta-26214) radiocarbon years B.P. near the headwaters at Boxley (Guccione 1989a, Spears et al. 1989) based on radiocarbon dates from two intact and intrusive cultural features extending 35 cm down into the underlying gravel. Abandonment occurred more than 3,040 radiocarbon years B.P. (Beta-21761) at an intermediate location at Erbie (Lafferty et al. 1988). This date of abandonment is based on a carbon sample from a postmold in a smudge pit area. Depths of the small postmolds associated with the smudge pit suggests that the Late Archaic surface was at or near that of the modern surface and that overbank sedimentation had ceased on the terrace surface before the smudge pit was constructed. Abandonment of sedimentation on the lowest terrace occurred between 1,650 and 2,500 years B.P. at a downstream location near Rush (Sabo et al. 1990). Diagnostic artifacts including Afton, Langtry, and Stone Squared Stemmed points and thick grog-tempered potsherds indicate that this most recent significant accumulation occurred during the Early Woodland, between 2,500 and 1,800 years B.P. The overlying Middle to Late Woodland midden and living floor near the present ground surface indicates that significant sedimentation on this surface had ceased between 1,800 and 1,350 years B.P.

This downstream direction of time-transgressive incision is opposite the generally accepted model of lowered base level. Time-transgressive incision may suggest increased sediment yield throughout the basin caused by climatic change at approximately the Pleistocene/Holocene boundary. Increased sediment supply from upstream areas may have required greater aggradation over a longer period of time in downstream areas. This observed trend of decreasing age downstream should be tested during future excavations on the terrace and floodplain of the Buffalo River. If the other sites support this generalization, proxy climatic indicators should be examined to determine if climatic change is a viable hypothesis.

CHAPTER 5

The Archeology of the Dalton Area

RANDALL L. GUENDLING

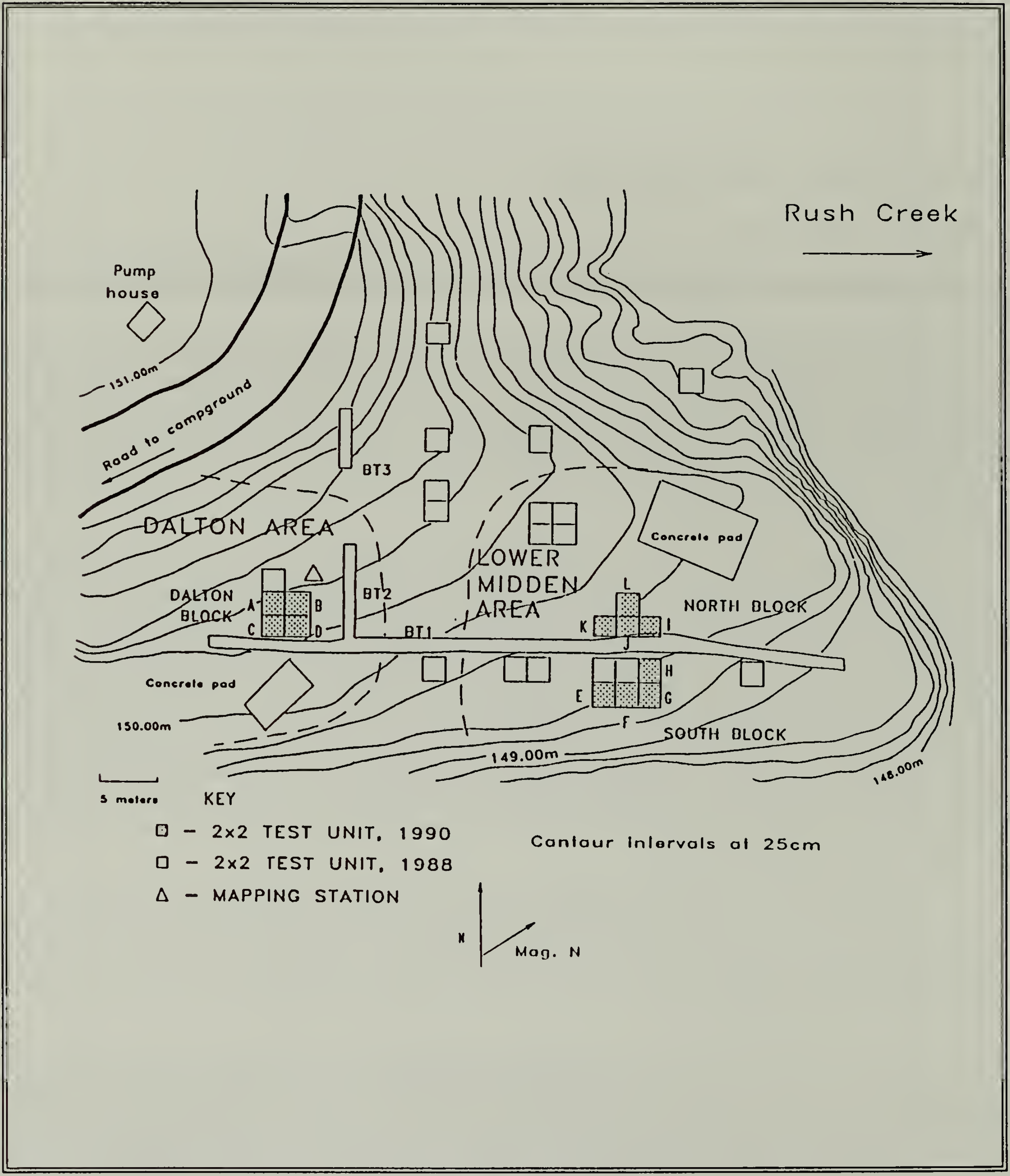
This chapter discusses the 1990 excavations in the portion of 3MR80-Area D identified as the "Dalton Area", describes the artifacts produced as a result of the excavations, and provides an assessment of this portion of the Dirst Site based upon both seasons' work. Although the 1988 testing of the Dalton Area indicated the existence of highly significant cultural deposits, more extensive excavation in 1990 found no prehistoric features and determined furthermore that much of this area had been subject to various forms of disturbance. Consequently, we believe the research potential of this part of the site has been exhausted, and we suggest that no further mitigation efforts are necessary.

The portion of 3MR80-Area D labeled the Dalton Area (Figure 5.1) was one locus of additional excavation in 1990. Here, the 1988 excavations identified a buried paleosol, designated 1b, as the stratigraphically lowest cultural unit on the Dirst site (Sabo et al. 1990:132-133). This stratum overlay a Pleistocene age gravel deposit that forms the core of the terrace projection containing 3MR80-Area D. Artifacts found in the portion of the trenching that exposed Stratum 1b were diagnostic of the Dalton and Early Archaic periods, or about 10,500-8,000 B.P.(Sabo et al. 1990:132-133). A single test unit N998/E995 was excavated in an area just east of the campground road where the paleosol lay near the present ground surface. Here Stratum 1b was only buried about 50 cm deep and was easily reached using hand excavation methods. The shallow depth of the stratum at this locus renders it susceptible to potential destruction by proposed campground construction. Though no features were found in this stratum, the occurrence of Dalton and Early Archaic artifacts in apparently primary contexts of deposition prompted the recommendation that the artifact sample from these strata be increased through additional excavation.

To this end a 4 m x 4 m block was flagged immediately south of the 1988 excavation (Figure 5.2). The south half of N998/E995 was reopened as a profile guide to stripping. The overburden identified as 1988 backfill plus a disturbed stratum 20-30 cm thick (Sabo et al. 1990:132) was removed by backhoe and four 2 m x 2 m units staked for excavation. A short two meter section of Backhoe Trench 1 paralleling what became known as the Dalton Block was also reopened.

Four 2 m x 2 m units; N994/E995, N994/E997, N996/E995 and N996/E997 were staked within the block (Figure 5.1). The two eastern units, N994/E997 and N996/E997 were completed to the base of Stratum 2 and N996/E997 was excavated into Stratum 1b (Figure 5.3). The two western units, N996/E995 and N994/E995 only had one 10 cm level removed largely because the high clay content of Strata 1b and 2 impeded drying after heavy rains flooded the block. Whereas the lower midden area sediments were coarser textured and drained quickly, the Dalton area sediments turned to a viscous mud with rain that never dried sufficiently to permit screening.

The top of Stratum 1b was reached at 149.98 m AMSL in the north end of N994/E997 (Figure 5.3) and at 149.89 m AMSL, 9 cm deeper in the south end of the unit. The strata dipped to the south from this point. The transition from Stratum 2a to 1b took place over a leached zone between the two strata which overlay the much more compact sediments of the lower stratum (see Sabo et al. 1990:102-104 for detailed sediment descriptions).



A	N996/E995	E	N988/E1026	I	N994/E1030
B	N996/E997	F	N988/E1028	J	N994/E1028
C	N994/E995	G	N988/E1030	K	N994/E1026
D	N994/E997	H	N990/E1030	L	N996/E1028

Figure 5.1. Excavation units in the Dalton Area.

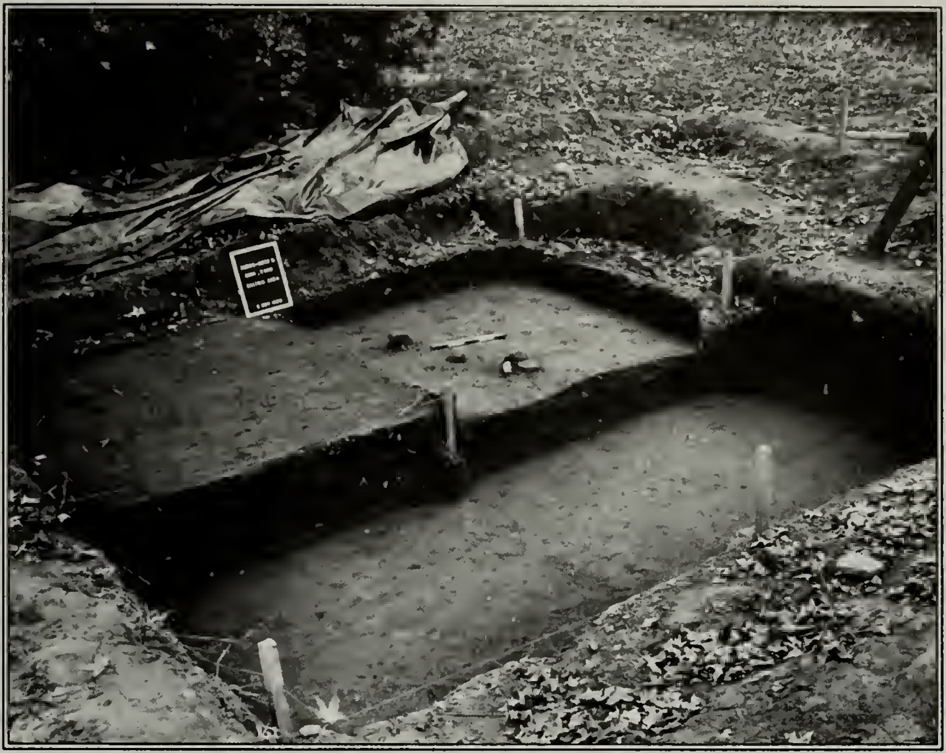


Figure 5.2 Completed Dalton block excavations (AAS Neg. # 905654).

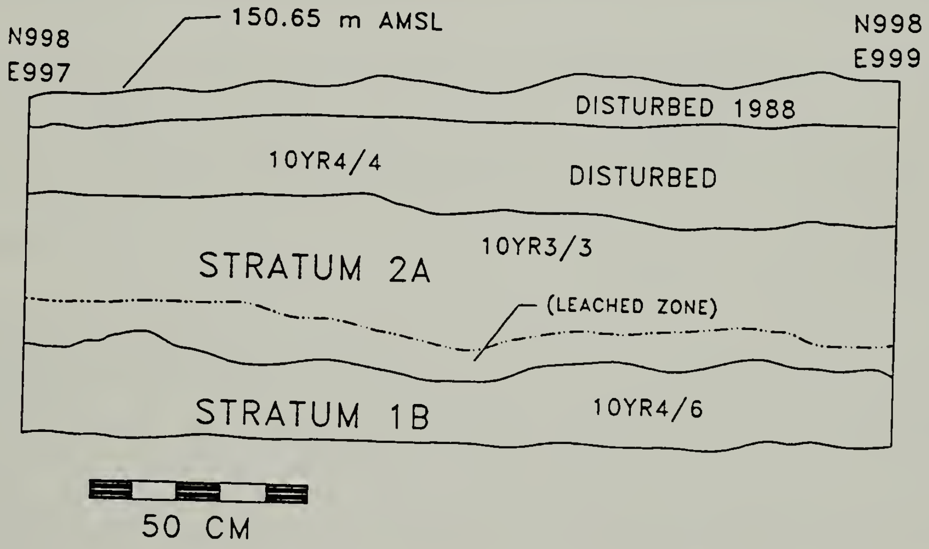


Figure 5.3 North wall N996/E997, Dalton Area.

A small irregular shaped stain was uncovered at 150.01 m AMSL in N996/E997 at the 2a/1b transition adjacent to the north wall. This very faint stain, assigned Feature number 12, was elongated 50 cm north to south and 25 cm wide (Figure 5.4). When cross sectioned the feature appeared 20 cm deep with numerous small protrusions extending randomly into the sides; one protrusion extended steeply downward from the south end. Feature 12 was not apparent in the north wall profile after continued excavation. The feature was interpreted as a rodent burrow or small filled root mass associated with the lower portion of Stratum 2a. No other features were encountered in the Dalton Block. However, a large sample of lithic artifacts was gathered from the levels that were completed.

Dalton-Early Archaic Component, Stratum 1b

The 1990 excavations in Stratum 1b produced one temporally diagnostic dart point, a Williams point. Williams points have been found with material radiocarbon dated between 8500-5100 B.P. elsewhere in the Ozarks and appear as Late Archaic forms in many contexts. The Williams point found in Stratum 1b, however, most likely represent an Early Archaic form.

A total of eleven lithic tools (Table 5.1), including the Williams dart point, were sorted from the lithic assemblage. None of the tools were heat treated and only one of the bifaces, a side scraper, and a hammerstone exhibited cortex on their surfaces. This represents 27% of the tools, compared with 22% with cortex in the 1988 assemblage from this area. This seems to suggest that the tool makers were not quarrying fresh material, but were relying on surface cherts or stream cobbles.

Table 5.1 Chipped Lithic Artifacts, Stratum 1b.

Function	N	Percent
Projectile points		
Dart	1	09
Maintenance, manufacturing, and processing		
Biface	3	27
Side scraper	1	09
Modified flakes	5	46
Stone tool production		
Hammer stone	1	09
Total	11	100

The stone tools themselves are all made of four identifiable raw material types (Table 5.2) and are the same as four of the six identifiable tool chert types found in 1988. However, a much wider range of raw materials are present (10 identifiable) in the stratum among flakes and shatter classifications (Tables 5.3, 5.4). This indicates that more stone tool working occurred than is represented by tool chert types recovered, as well as a wider stone resource procurement range. The Pitkin, Jefferson City cherts and quartzite are especially representative of non-local material. The closest source of quartzite was identified in southern Missouri (Sabo et al. 1990:204) where it occurs with Jefferson City dolomites. It is also noteworthy that the Jefferson City chert is the largest non-local flake category (Table 5.3).

The high mass of quartzite shatter (Table 5.4), 503.7 g out of 738.5 g, in the absence of tools or flakes of this material begs explanation. It would not have been imported long distance for stone boiling as all identifiable fire cracked rock from Stratum 1b was sandstone (1.027 kg). One lancolate

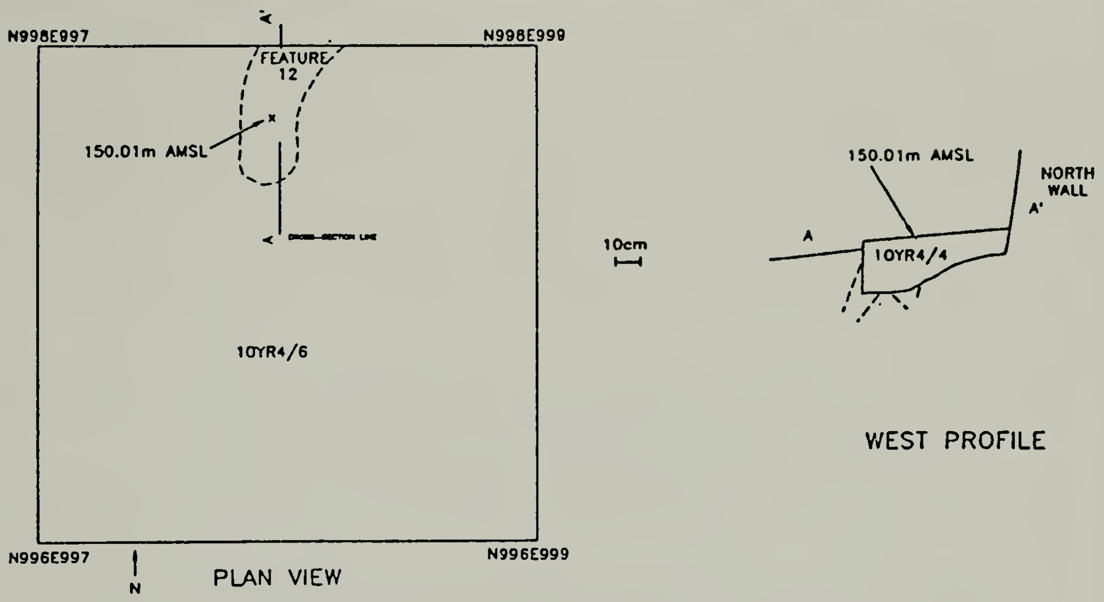


Figure 5.4 Feature 12, plan and profile view.

Table 5.2 Chipped Lithic Artifacts by Raw Material, Stratum 1b.

	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	TOTAL
Biface-knife	1			1								1	3
Hammer	1												1
Retouched flake	1			1		2						1	5
Side scraper								1					1
Dart				1									1

Table 5.3 Flakes by Weight(g) and Raw Material, Stratum 1b.

Size Grade	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	TOTAL
5.08	-	-	-	-	-	-	-	-	-	-	-	-	0
3.81	39.0	-	-	-	-	-	-	-	-	-	-	-	39.0
2.54	134.4	-	-	49.6	19.4	65.5	-	-	-	45.9	0	79.6	394.4
1.27	65.1	13.1	9.2	28.5	28.7	81.5	5.0	12.2	-	2.7	-	19.8	265.8
0.64	40.6	4.4	9.2	15.0	30.7	26.4	5.8	7.0	-	.2	-	42.4	181.7
Total	279.1	17.5	18.4	93.1	78.8	173.4	10.8	19.2	0	48.8	0	141.8	880.9

Table 5.4 Shatter by Weight(g) and Raw Material, Stratum 1b.

Size Grade	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	TOTAL
5.08	-	-	-	-	-	-	-	-	-	-	439.6	-	439.6
3.81	64.5	-	-	-	-	-	-	-	-	-	-	52.0	116.5
2.54	53.6	-	-	-	-	-	-	-	-	-	-	-	53.6
1.27	27.1	-	-	11.6	-	-	-	-	-	-	64.1	-	102.8
0.64	17.8	1.8	-	-	-	-	-	1.2	-	-	-	5.2	26.0
Total	163.0	1.8	0	11.6	0	0	0	1.2	0	0	503.7	57.2	738.5

point from the 1988 collections in this area was made of quartzite. Quartzite may have had a special significance to the occupants of the site, perhaps as items of trade or status indicators that were transported with the people during their seasonal rounds.

The wide range of material types, including locally available Boone, St Joe and Reeds Spring cherts as well as the non-local types, confirm inferences made earlier by Sabo. One inference was that the Dalton and Early Archaic period inhabitants of the Dirst Site imported stone resources from a large territory, either through residential mobility or trading networks. If non-local cherts were obtained through band mobility, a pattern of territoriality cross cutting several drainages would be indicated, as Schiffer (1975) suggested for Eastern Arkansas Dalton occupations. Conversely, if exotic raw materials were imported via trade networks, then individual band territories could have been smaller. These alternative hypotheses can be tested comparing stylistic variability among Dalton assemblages as more sites of this time period are discovered and excavated in the central and eastern Ozark regions.

A second inference concerned the availability of the local cherts themselves, relative to Kay's (1982b) hypothesis (formulated for the Pomme de Terre Valley region of southern Missouri) that many lower member cherts were covered by loess at this time period. The wide range of raw material types associated with Dalton-age deposits at Dirst Site indicates that hillslopes flanking the Buffalo River may not have been as extensively blanketed with loess as they evidently were along the Pomme de Terre River. The more abundant lithic material resources in the Buffalo River drainage may have been an important economic resource for Dalton period occupants of this valley.

Post-Dalton Components, Stratum 2a

The 1988 excavations indicated Stratum 2a represented an Early to Middle Archaic period occupation. Six temporally diagnostic dart points recovered during the 1990 excavations represent a much longer period of development of the half meter thick Stratum 2a deposit (Table 5.5). The point types (Figure 5.5) date from the Early and Middle Archaic period (Williams, White River, Graham Cave and Castroville) to the Late Archaic and Woodland periods (Stone Square Stemmed and Langtry). The presence of diagnostic artifacts representing over six millennia in little more than 50 cm of vertical distribution argues against the isolation of discrete assemblages. More importantly, some degree of unrecognized taphonomic disturbance has affected the stratum.

Table 5.5 Typed Projectile Points, Stratum 2a.

Langtry (Woodland 2000-1000 BP)	1
Stone Square Stemmed (Late Archaic-Woodland 3400-2000 BP)	1
Castroville (Middle Late Archaic 3400-3360 BP)	1
White River Archaic (Middle Archaic 6370-4840 BP)	1
Graham Cave (Early-Middle Archaic 850-5100 BP)	1
Williams (Early-Middle Archaic 8500-5100 BP)	1
Total	6

The White River (Middle Archaic) point was found 150.29-150.39 m AMSL along with five grog-tempered body sherds in the apparently undisturbed Stratum 2a. While the sherds may well have been introduced from the obviously disturbed context immediately above, the White River point is harder to explain away. Additionally, this context was stratigraphically above the Langtry point (elsewhere from dated Woodland contexts) and a plain, grog-tempered rim, both from 149.96-150.06 m AMSL at the base of Stratum 2a. The remaining dart points, however, do appear to be in proper stratigraphic order.

It is plausible that the two points and the sherds may have all been introduced from elsewhere on the site, either through natural or recent cultural agencies, into an otherwise in situ context. However, the Stratum 2a sediments displayed no indication of these types of disturbances in the levels in question other than the presence of Feature 12. It is therefore just as plausible that the stratum has undergone some mixing of contexts, though the degree of disturbance cannot be identified with the present data.

A total of 175 lithic tools were recovered from the stratum (Table 5.6), but only 28 (16%) of the total had cortex on their surfaces (Table 5.7). This is close to the pattern of cortex removal noted in 1988 of 20% of that total. Heat treatment was also a minor technological innovation throughout the time period represented by Stratum 2a as well as 1b (Table 5.8), though this contrasts with the pattern observed by Sabo. Since the recognition of annealing on chert is somewhat subjective, I would suspect that the difference between a 2% and 20% rate of heat treatment is as likely due to the observer as the observed.

The pattern of raw material usage remains the same between strata in the Dalton Area with the heaviest reliance on local cherts. In this case the most utilized chert types are Light Boone, St Joe (both Green and Jasper are phases of the same member) and Reeds Spring in that order. Of special note is that tools (Table 5.9), flakes

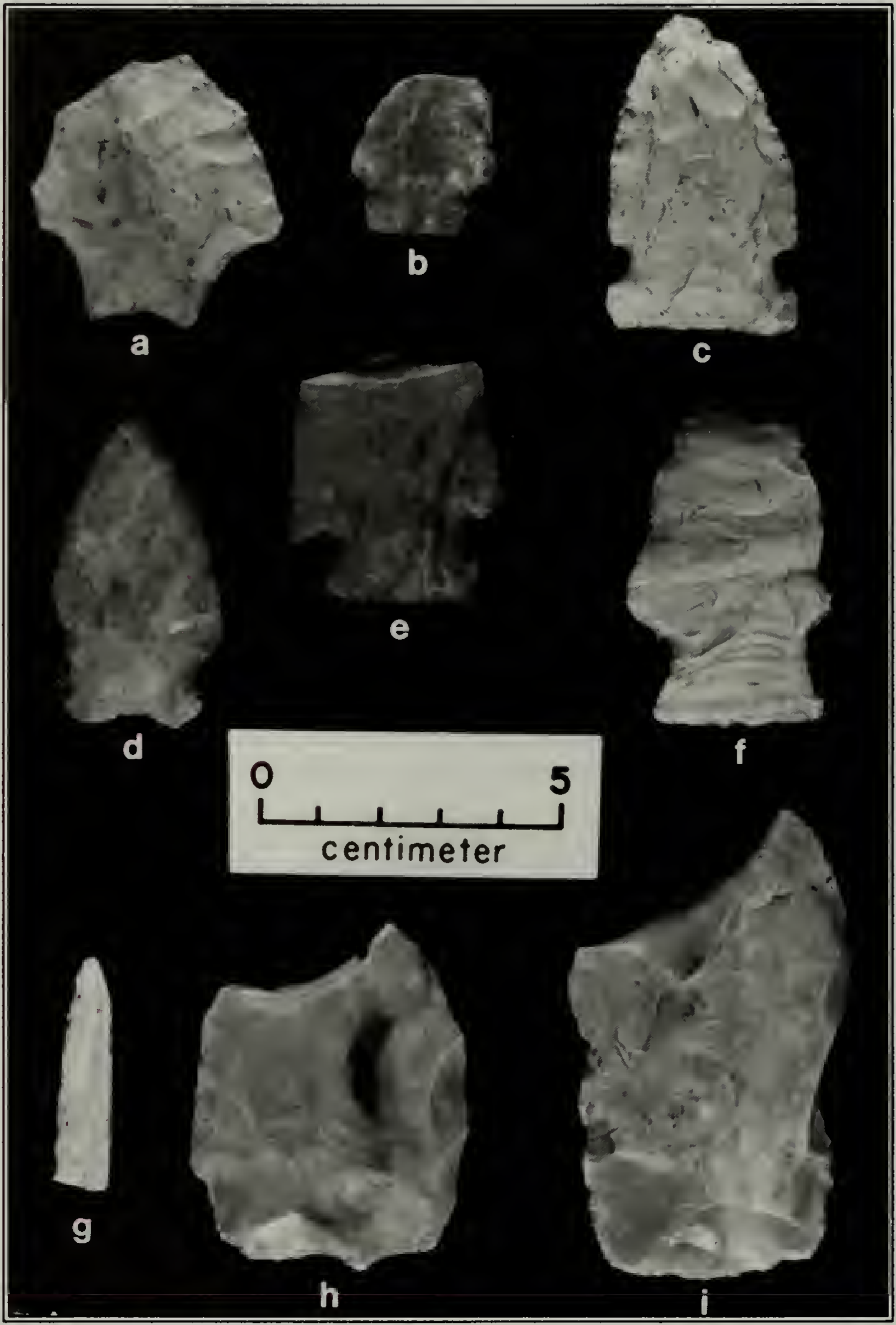


Figure 5.5 Artifacts from Stratum 2a a.Langtry; b.Stone Square Stemned; c.White River Archaic; d.Graham Cave; e,f.untyped Archaic dart points; g.awl tip; h.biface; i.side scraper (right edge). (AAS Neg. #916034).

Table 5.6 Chipped Lithic Artifacts, Stratum 2a.

Function	N	Percent
Projectile points		
Dart	8	05
Maintenance, manufacturing, and processing		
Biface	52	30
+ Knife	2	01
Drill/Awl	2	01
Side scraper	3	02
Spokeshave	1	*
Modified flakes	88	50
Chopper	1	*
Stone tool production		
Pebble core	1	*
Tabular core	1	*
Tested cobble	6	03
Tested pebble	2	01
Unprepared core	8	05
Total	175	98(100)

* Less than .01

same descending order. Furthermore, the covarience of all three classifications by chert type, representing primary and secondary steps in the toolmaking process, strongly suggests raw material was being brought to the site to work rather than initially reduced at a quarry site. However, when the size ranges of whole tools in both strata are considered (Table 5.12), it can be readily recognized that the chert cobbles available in the Rush and Clabber creek beds are sufficient to provide the raw material for any tools in the Dalton Area.

Table 5.7 Chipped Stone Artifacts with Cortex, Stratum 2a.

	Cortex	No Cortex	Total
Biface	8	44	52
Drill/awl	1	1	2
Knife	1	1	2
Pebble core	1		1
Side scraper	3		3
Tabular core	1		1
Tested cobble	4	2	6
Tested pebble	2		2
Unprepared core	7	1	8
Total	28(16%)	49(28%)	77(175 tools total)

Table 5.8 Heat Treated Tools, Stratum 2a.

Stratum 2a	HT	NOT HT	TOTAL
Dart	1	7	8
Biface	2	50	52
Knife		2	2
Drill/Awl		2	2
Side scraper		3	3
Spokeshave		1	1
Modified flakes	1	87	88
Chopper	1	0	1
Pebble core		1	1
Tabular core		1	1
Tested cobble		6	6
Tested pebble		2	2
Unprepared core		8	8
Total	5(03%)	170(97%)	175

Table 5.9 Chipped Lithic Artifacts by Raw Material, Stratum 2a.

Size	LBOONE		BBOONE		STJOEJ		REEDSB		COTTER		QZIT		
Grade		GBOONE		STJOEG		REEDSG		PITKIN		JEFCIT		UNID	TOTAL
Retouched flake	18	9	2	20	11	15		1		2		10	88
Dart	3	1		1		1		1	1				8
Biface-knife	20	7		5	1	10						7	50
Drill/Awl	1	1											2
Chopper										1			1
Knife	1					1							2
Side scrapper	1			1	1								3
Spokeshave	1												1
Tested cobble	4												4
Tested pebble	2												1
Unprepared core	3			1	2	1						1	8
Tabular core				1									1
Pebble core					1								1
Total	54	18	2	29	16	28	0	2	1	3	0	18	171

Table 5.10 Flakes by Weight(g) and Raw Material, Stratum 2a.

Size Grade	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	TOTAL
5.08	73.3	-	-	-	-	-	-	-	-	-	-	-	73.3
3.81	175.6	-	-	-	-	-	-	-	-	-	-	24.2	199.8
2.54	338.5	63.4	62.9	42.4	53.2	145.7	-	-		17.1	-	188.3	911.5
1.27	820.0	105.0	63.9	386.0	437.4	694.2	37.9	12.8	1.4	9.4	4.3	147.2	2719.5
0.64	625.7	98.6	62.6	233.1	336.7	246.4	14.7	42.1	3.8	10.6	6.1	233.2	1913.6
Total	2033.10	267.0	189.4	661.5	827.3	1086.3	52.6	54.9	5.2	37.1	10.4	592.9	5817.7

Table 5.11 Shatter by Weight and Raw Material, Stratum 2a.

Size Grade	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	TOTAL
5.08	-	-	-	-	-	-	-	-	-	-	-	-	0
3.81	46.8	-	-	-	-	-	-	-	-	-	-	-	46.8
2.54	190.2	-	-	-	-	24.7	-	-	-	-	44.5	32.5	291.9
1.27	193.7	9.1	-	41.7	32.7	65.3	-	-	-	-	-	54.8	397.3
0.64	271.4	23.4	-	17.4	19.8	22.7	-	.3	-	1.5	2.7	84.8	444.0
Total	702.1	32.5	0	59.1	52.5	112.7	0	.3	0	1.5	47.2	172.1	1180.0

Table 5.12 Chipped Stone Artifact Size Ranges (Length in cm).

Stratum 1b	Minimum	Maximum	Average
Dart		5.1	
Side scraper		4.5	
Stratum 2a			
Dart	4.67	5.64	5.15
Side scraper	3.39	7.97	5.68
Biface	4.85	9.01	6.93
Chopper		9.87	
Abrader		2.82	

The distribution of raw material types in Stratum 2a also shows a small but consistent presence of non-local cherts indicating a continuation of territorial ranging or trading by the inhabitants. However, the apparent duration (possibly as long as 7500 years) of the occupation uncovered in the Dalton block leaves little else that can be inferred from this pattern.

Conclusion

The work completed in the Dalton Area in 1988 identified an intact Dalton component that was potentially susceptible to impact by proposed development slated for Area D. This notion has been dispelled by the 1990 work. The Dalton and Early Archaic artifacts recovered from Stratum 1b in both season's investigations indicate an ephemeral occupation that is not likely to produce additional significant information. The overlying Stratum 2a collections are also of limited use for further study other than adding to the number of projectile points now curated. Neither stratum appears to have the potential for features and further excavation of the components as they are preserved in the Dalton Area does not seem justifiable.

CHAPTER 6

Archeology of the Lower Midden Area

RANDALL L. GUENDLING

This chapter describes the 1990 excavations in the Lower Midden Area of 3MR80-Area D. Analysis and interpretation of the archeological evidence recovered from these excavations is presented in Chapters 7-9.

The 1990 excavations in the Lower Midden Area of 3MR80-Area D were a continuation of the focus on data recovery begun in 1988 (Sabo et al. 1990:107-152). A major objective of the excavations was to determine if multiple, temporally discrete components could be identified in the Stratum 5 midden. Other objectives were to expand excavations in the area where an arc of postmolds had been discovered in Stratum 4 during the 1988 excavations and to explore further the nature of occupations represented in Stratum 4 and 5, the deposits most likely to be affected by proposed campground construction. A detailed description of the strata can be found in Guccione and Guendling (1990:99-106).

Two block excavations were placed on the north and south sides of Backhoe Trench One to intersect the features in Strata 4 and 5 exposed during the 1988 excavations (Figure 6.1). Four 2 m x 2 m excavation units were staked on the north side of the trench; N994/E1026, N994/E1028, N994/E1030 and N996/E1028. These units were collectively referred to as the North Block (Figure 6.2) and all were excavated through Stratum 5 and into Stratum 4. One unit, N996/E1028, was taken through Stratum 3 and into Stratum 2 to a depth of 1.1 m below the surface. The North Block was centered between a large postmold (Feature 17) exposed in the south wall of the backhoe trench and a circular pit exposed in the north wall identified as Feature 13. These two features were thought to be part of a possible house structure in the Stratum 5 midden.

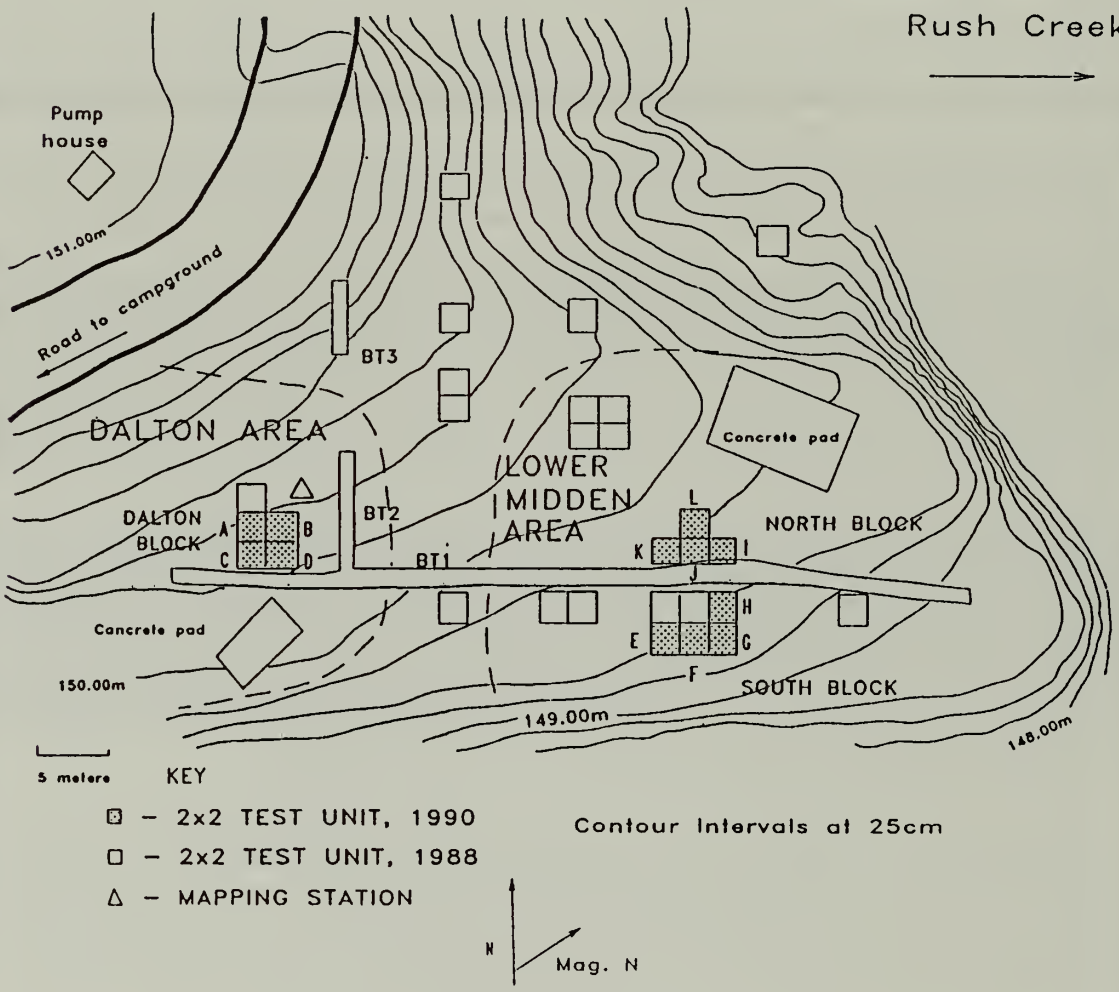
On the south side of the backhoe trench, four 2 m x 2 m units were staked south and east of the two 1988 units N990/E1026-1028 that exposed a partial arc of postmolds in Stratum 4 (Figure 6.1). These units were N988/E1026, N988/E1028, N988/E1030 and N990/E1030. These units were collectively known as the South Block (Figure 6.3) and all were excavated through Stratum 5 and into Stratum 4. The South Block units were placed to expose the remainder of the arc of postmolds in Stratum 4 and to search for additional features in the Stratum 5 midden.

North Block Units

Two of the North Block units N994/E1028 and N994/E1030 were not quite full 2 mx 2 m excavations. The southeast 30 cm of E1028 and the southern 40 cm of E1030 had been removed by Backhoe Trench One. Six meters of Backhoe Trench One separating the blocks were reopened and the north balk of 1988 units N990/E1026-1028 was exposed as a profile guide.

N994/E1026, N994/E1028, N994/E1030, N996/E1028

Excavation was initiated along the North Block by removing and discarding all backdirt from the 1988 excavations and the 1982 flood sands from each unit surface. Excavation levels were begun from the top of the Stratum 5 midden (the midden surface was approximately 10-15 cm below the 1990 surface) and continued to the



A	996/995	E	988/1026	I	994/1030
B	996/997	F	988/1028	J	994/1028
C	994/995	G	988/1030	K	994/1026
D	994/997	H	990/1030	L	996/1028

Figure 6.1 Excavation units, Lower Midden Area.

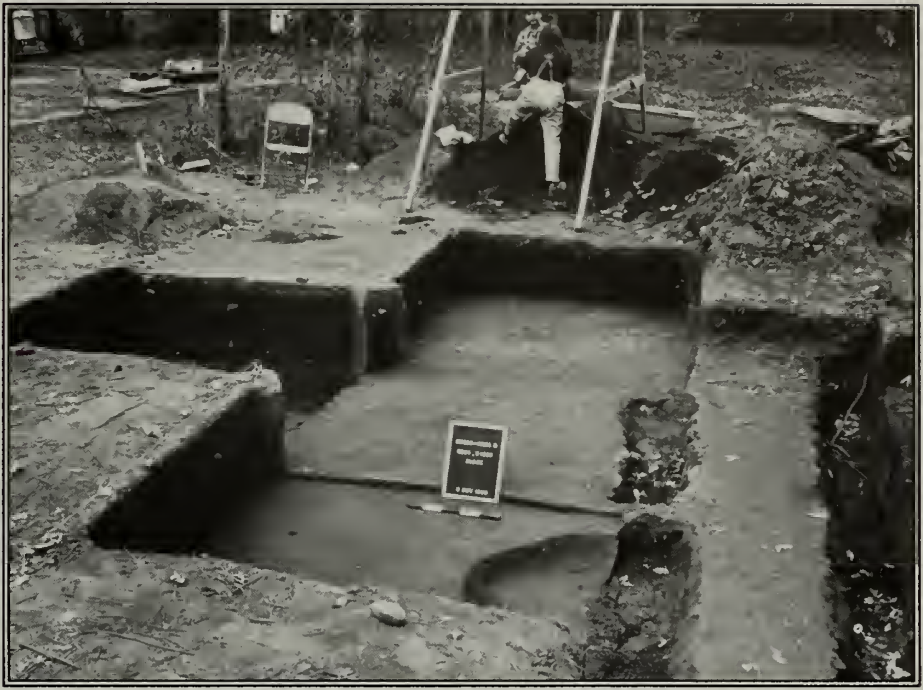


Figure 6.2 Completed North Block excavation, Lower Midden Area. Drainage ditches are dug into the floor of backfilled Backhoe Trench One at the right, excavated Feature 13 is in the foreground. (AAS Neg. #905632).

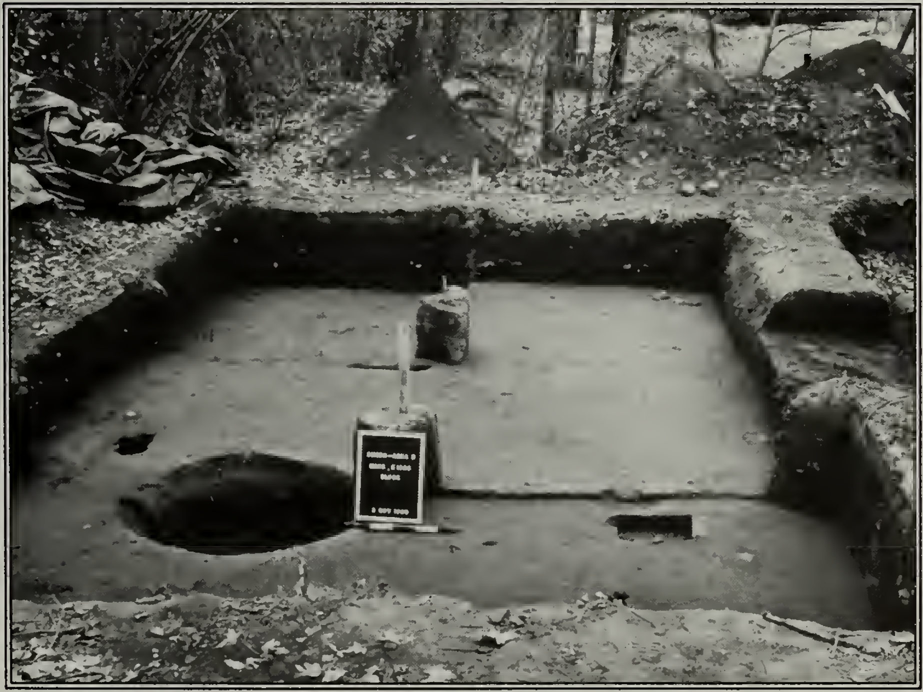


Figure 6.3 Completed South Block excavation, Lower Midden Area. Backhoe Trench One is to the right, excavated Feature 14 in the foreground. (AAS Neg. # 905629).

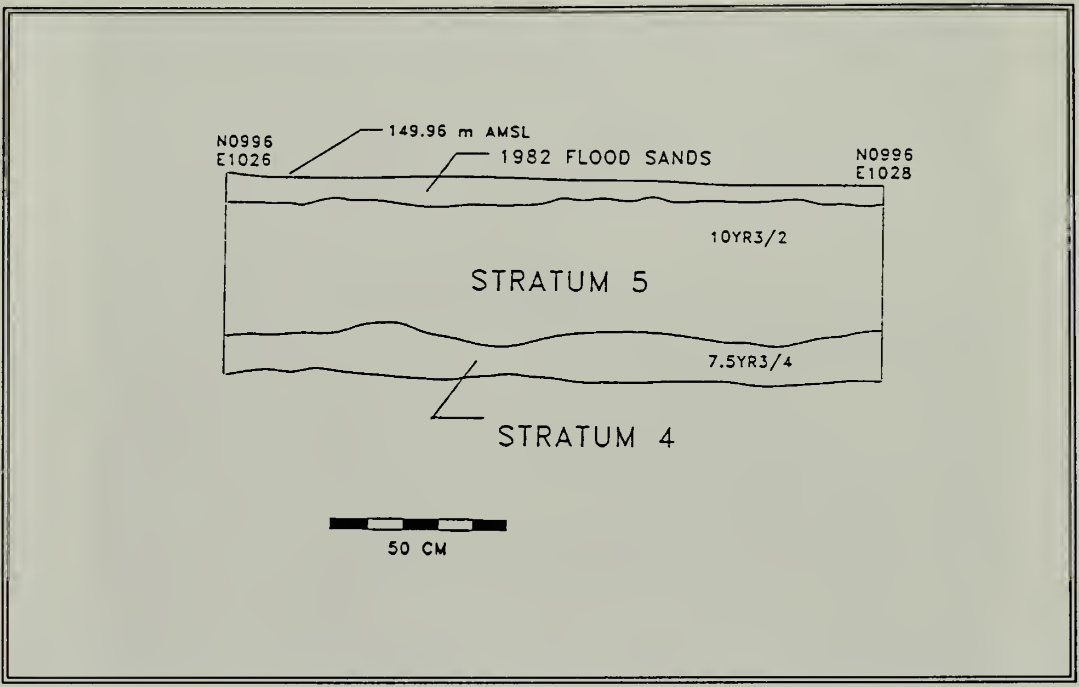


Figure 6.4 North wall profile, N994/E1026.

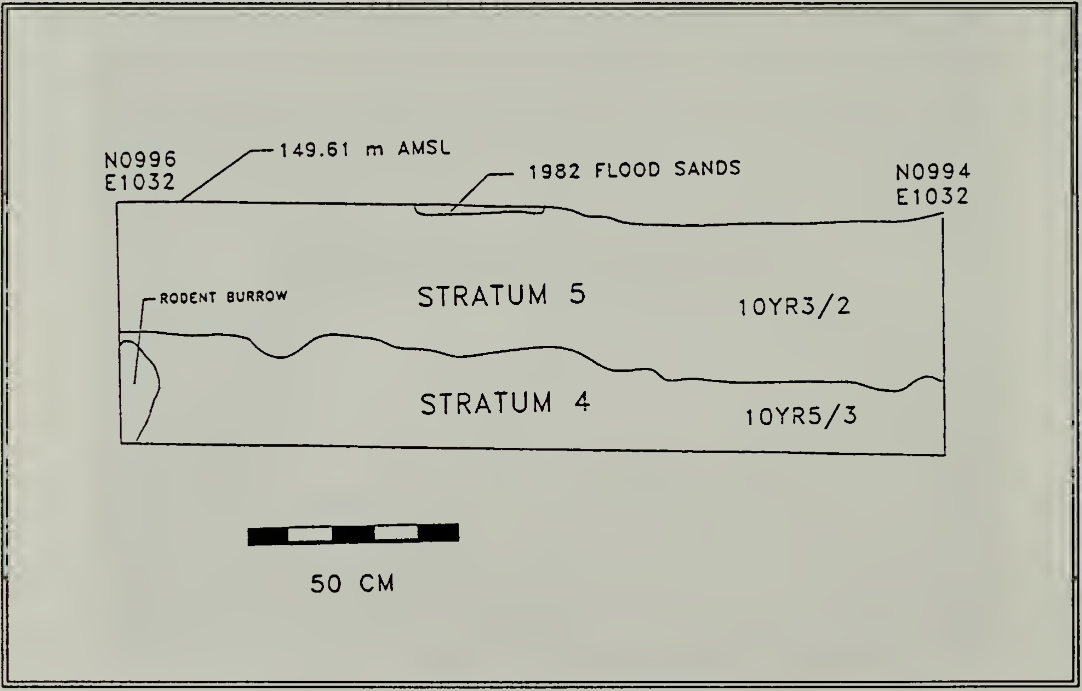


Figure 6.5 East wall profile, N994/E1030.

base of the midden about 40 cm below the surface (Figure 6.4, 6.5). The strata sloped slightly south and east away from the crest of the terrace, conforming to the surface topography. Three of the units were excavated one 10 cm level into the underlying Stratum 4 at approximately 50 cm below the surface. One unit, N996/E1028 was selected for deeper excavation in order to sample the below midden strata. By the end of the fieldwork period this unit had been taken to 1.1 m below the surface (Figure 6.6, 6.7) and excavated through a 20 cm thick Stratum 4, a 30 cm thick Stratum 3, and one 10 cm level into Stratum 2.

Four features were defined within the Stratum 5 midden in the North Block. Feature 11 was a small cylindrical plug of thickly clustered flakes, bone and charcoal flecks at 149.42 m AMSL (about 20 cm below the surface) in the northwest corner of N994/E1026. Feature 13 was a circular pit located in the southern half of the same unit. It had been mapped in the north wall profile of Backhoe Trench One in 1988. This feature was defined at 149.21 m AMSL (37 cm below the surface) near the base of the midden. Feature 10 was another circular pit cut in half by the backhoe trench. It was defined at 149.20 (40 cm below the surface) near the base of Stratum 5 as a dark stain that extended across the southeast portion of N994/E1028 and the southwest portion of N994/E1030. Feature 15 was recognized at 149.48 m AMSL (22 cm below the surface) in the northwest corner of N996/E1028. This feature was a very large basin shaped pit that originated in Stratum 5 and intruded through Stratum 4 into Stratum 3. Analysis of these features is presented below.

South Block Units

N988/E1026, N988/E1028, N988/E1030, N990/E1030

Excavation began in the South Block with reopening of the 1988 units N990/E1026-E1028. Both were re-excavated to 149.42m AMSL (50 cm below the surface) to expose the plastic covered surface in Stratum 4 where the partial arc of postmolds were exposed. The top of Stratum 5 was then exposed in the adjacent units and excavation levels continued to the bottom of the midden. Three of the four units were excavated one 10 cm level into Stratum 4 (Figure 6.7-6.9). Unit N988/E1026 was dug to the top of Stratum 4 and troweled clean even with the bottom of 1988 unit N990/E1028 to investigate a suspected feature (Feature 9). Another suspected feature (Feature 16) was exposed in N988/E1028. Upon excavation it was determined that neither feature was of prehistoric origin.

Three other features were discovered originating in the Stratum 5 midden in the South Block units. Feature 14 was a circular pit defined at 149.04 m AMSL (30 cm below the surface of the midden), extending across the E1030 grid line into both the east half of N988/E0130 and the west quarter of N988/E1028. Two postmolds, Feature 19 and 20, were found originating at 149.19 and 149.17 m AMSL (approximately 25 cm below the surface) in N988/E1030. Analysis of these features is presented below.

Units N988/E1026, N988/E1030 and N990/E1030 were excavated into Stratum 4 below the level of the postmold arc found at 149.94 m AMSL in 1988 in N990/E1026-1028 (Figure 6.3). N988/E1026 appears to have been disturbed at the contact between Stratum 5 and 4. On the south side of the arc, N988/E1028 was leveled even with N990/E1028 and carefully troweled, but none of the units exposed a continuation of the arc of postmolds. The arc as mapped (Sabo 1990:131) would have continued into N990/E1030. We can only suspect that ground disturbance by subsequent occupations, such as the construction and use of Feature 14, may have obliterated earlier postmold patterns. Conversely, erosion of the edge of the gully immediately south of these units (Figure 6.1) may have removed the southern portion of the postmold pattern. It should be noted that both postmold features 19 and 20 were barely preserved at their points of discovery and could not be defined with confidence in profile.

Rock Strewn Surface

One of the more interesting features discovered in the 1988 excavations was the "rock strewn surface", which was interpreted as a compacted living surface strewn with with fire cracked rock and other cobbles at the base of Stratum 5. This surface was recognized in all units excavated in 1988 that reached the base of Stratum 5. The rock strewn surface was not recognized, however, in all units excavated to the base of Stratum 5 in 1990, nor

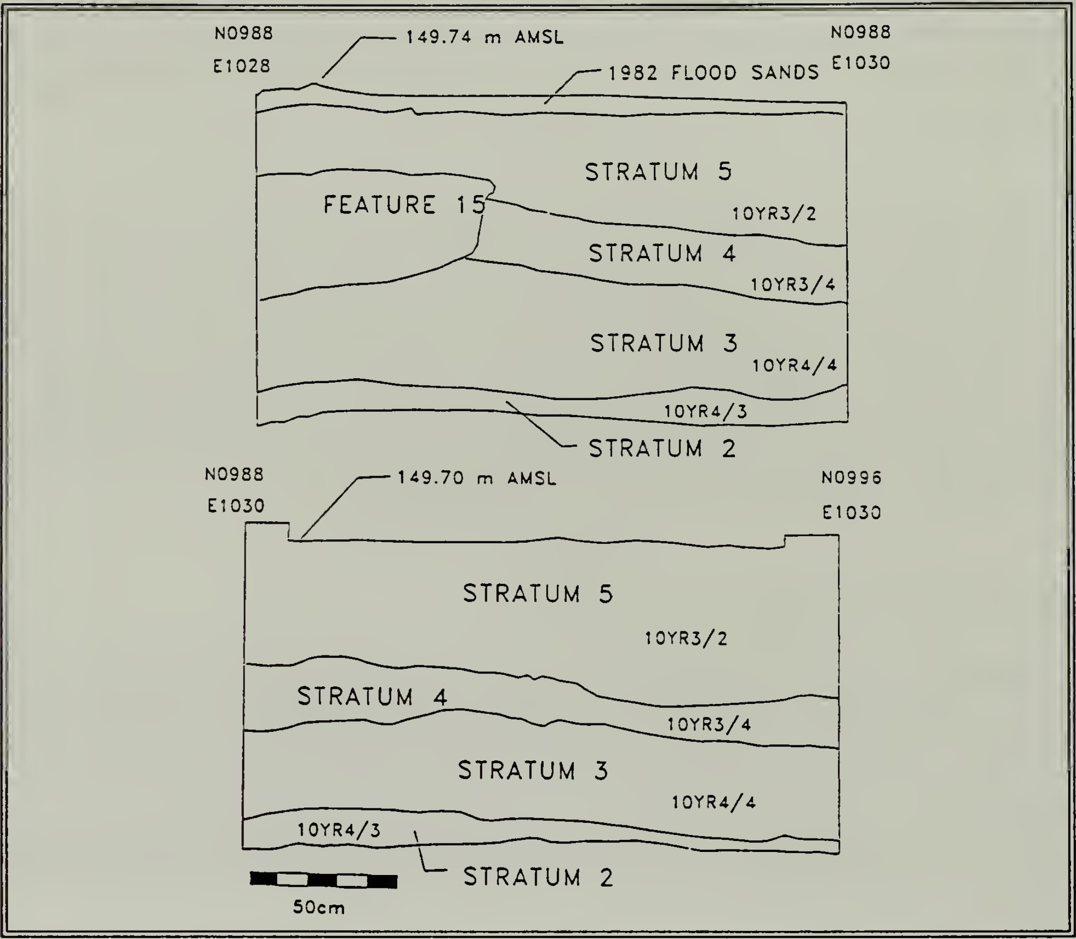


Figure 6.6 North wall and east wall profile, N996/E1028.

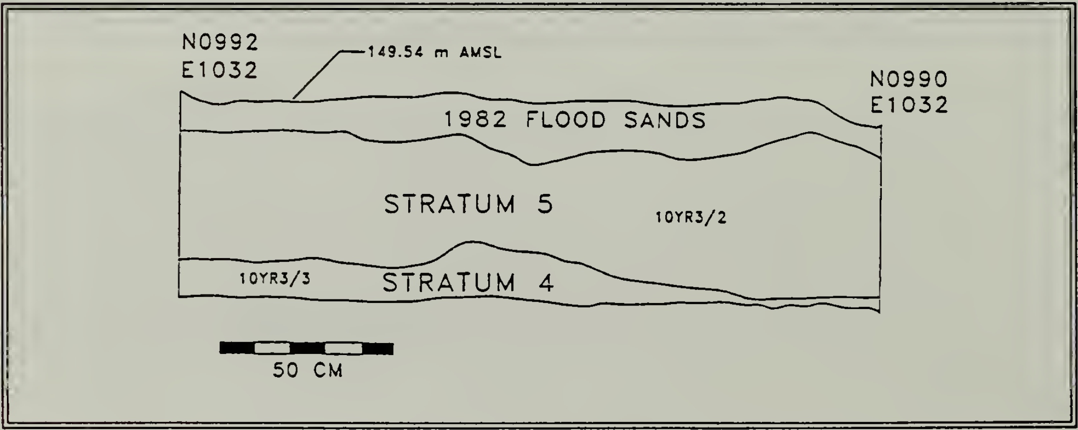


Figure 6.7 East wall profile, N990/E1030.

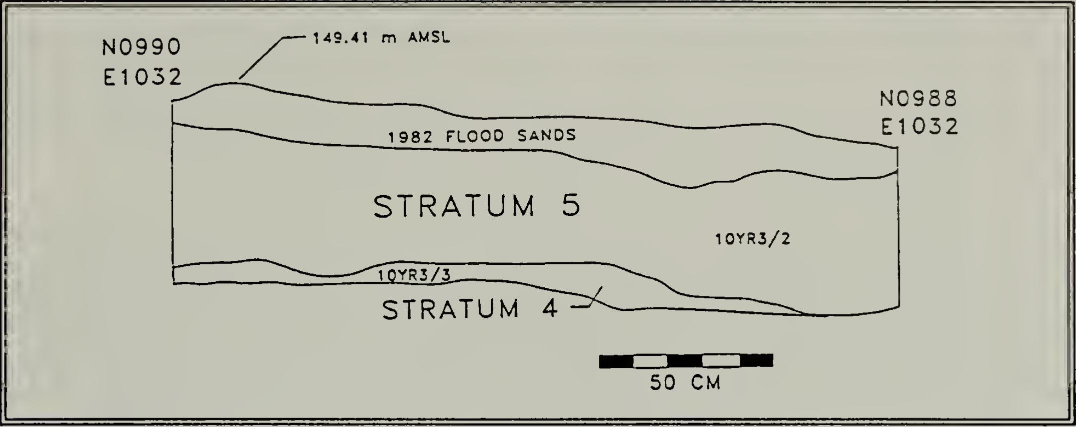


Figure 6.8 East wall profile, N988/E1030.

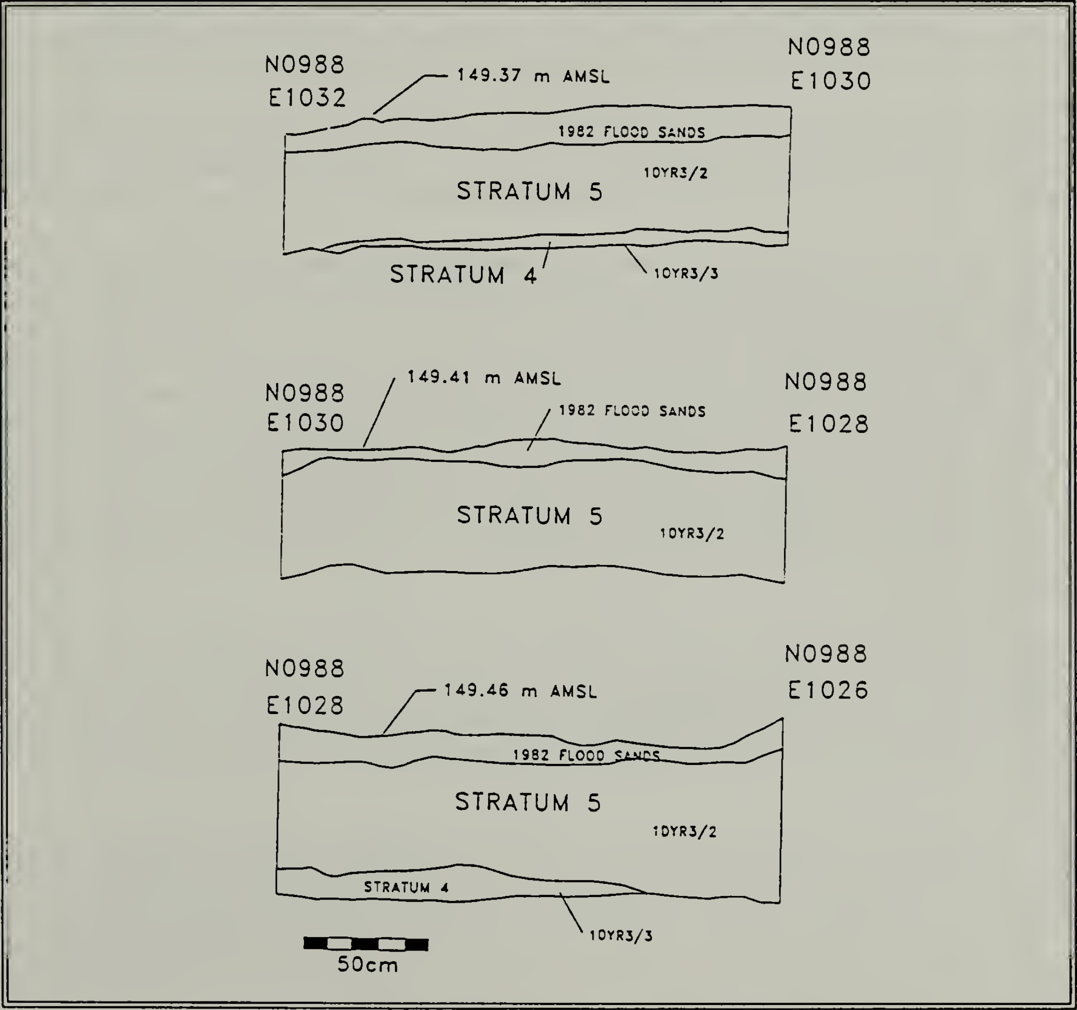


Figure 6.9 South wall profile, N988/E1026-1030.

was it located at the same level in the units where it was recognized. In the North Block units this surface was recognized in only two units -- N994/E1030 at 20-25 cm below the midden surface, and N996/E1028 at 25-30 cm below the midden surface. In the South Block it was not recognized in N988/E1030, but was at two different levels in the other units -- in N988/E1026-1028 at 30-35 cm and in N990/E1030 at 20-25 cm below the midden surface. All of these levels were 5 to 20 cm higher than the living floors defined in 1988 and were even at different levels in contiguous units. When recognized, the "rock strewn surface" was dug in 16 separate 50 cm blocks per 2 m x 2 m unit to gain a tighter control over the spatial distribution of artifacts.

It became apparent during analysis, that fire cracked rock and unmodified stone were present in large quantities in all levels within the Stratum 5 midden. In fact, there appeared to be no significant differences in the amounts of rock associated with the "rock strewn surface" and other levels excavated into the midden. The number of rocks exposed in a level was mainly a function of where the arbitrary 10 cm excavation levels ended. Therefore, "living floors" are not treated here as separate analytical units. This is not to say the identification and mapping of the rock strewn living floors in 1988 was spurious. Indeed, what it does suggest is the compacted rock strewn living floor may only represent a locus at which a more intensive level of occupational activity took place. Activity areas are, by definition, discontinuous across a site, an assumption which fits the data collected in 1990.

Features

Feature 10 This shallow, flat bottom, basin shaped pit was defined near the base of Stratum 5. It was noted as an indefinite area of darker soil with charcoal, shell and slightly reddened earth in the last 10 cm level of Stratum 5 at 149.22 m AMSL. A clearer boundary was recognizable against the lighter Stratum 4 soil into which Feature 10 intruded (Figure 6.10). The feature had been cut roughly in half by the backhoe trench. It measured 1.1 m in diameter and was approximately 15 cm deep as measured from the east wall profile. The west half of the feature appeared shallower, 8-15 cm, but this may have been a problem in recognizing the upper part of the feature when excavating the level (the west half was exposed first in N994/E1028 and the east portion exposed later).

The volume of the feature is 120.9 liters, and assuming the excavated portion is half, the total feature volume would have been 241.8 liters. The presence of oxidized soil confined to the feature and its shallow depth suggest use as a hearth rather than as a storage pit.

Feature 11 This feature appeared to be a concentrated cylindrical mass of chert flakes, some charcoal flecks, mussell shell fragments and animal bone (Figure 6.11, 6.12) at 149.42 m AMSL. The mass of flakes was 32 cm in diameter and 20 cm deep. The flake concentration was surrounded by a very faint stain of slightly darker soil. The mass of artifacts was partially overlapped by a thin lense of charcoal at its point of origin that may be an inclusion in the midden rather than part of the feature itself. Identifiable charcoal flecks were part of the feature in profile, though the color of the feature did not differ from the surrounding midden. The bottom of the feature coincided with the top of Stratum 4, but no feature intruded into that stratum when it was fully exposed during later excavation.

The narrow dimension of the feature suggested, at first, a filled rodent burrow or tree root. However, the lack of indication that it continued into Stratum 4 or presence above the point of origin indicates a restricted architectural function. The feature does align with two other postmolds, Feature 17 and Feature 19 and is interpreted as a probable post in a structure wall. The diameter of the feature may be inclusive of both the post and the hole dug to receive it.

Feature 13 This feature was mapped during the first phase of mitigations in the north profile wall of Backhoe Trench One. It was first noted in excavation as traces of burned clay and charcoal near the bottom of Stratum 5 at 149.21 m AMSL. By the end of the level the feature was well defined as a circular pit. Excavation revealed a flattened, basin shaped bottom (Figure 6.13). The fill contained burned clay, mussel shell, charcoal, bone, flakes and pottery. An area of lighter colored soil, visible in the profile in the east end of the feature, appeared to be a lens of ashy soil. The diameter of the pit was 1.5 m and it was 24 cm deep.

Projecting a circular shape for the pit, the intact portion represents approximately 45 % of the original feature. The excavated fill volume approaches 153.3 liters (or 340.6 liters for the complete feature). The function of the pit is not clear, though the burned earth and fire cracked rock may suggest some sort of cooking activity.

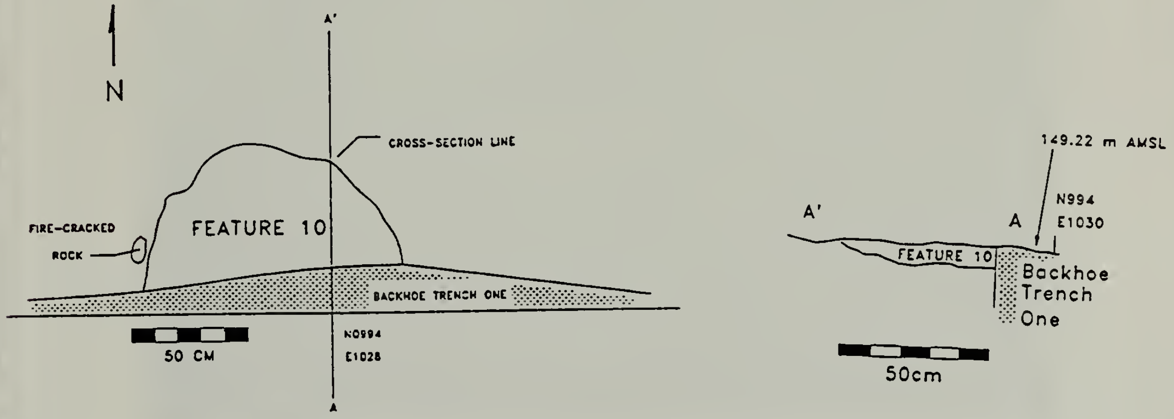


Figure 6.10 Feature 10 plan and profile map.

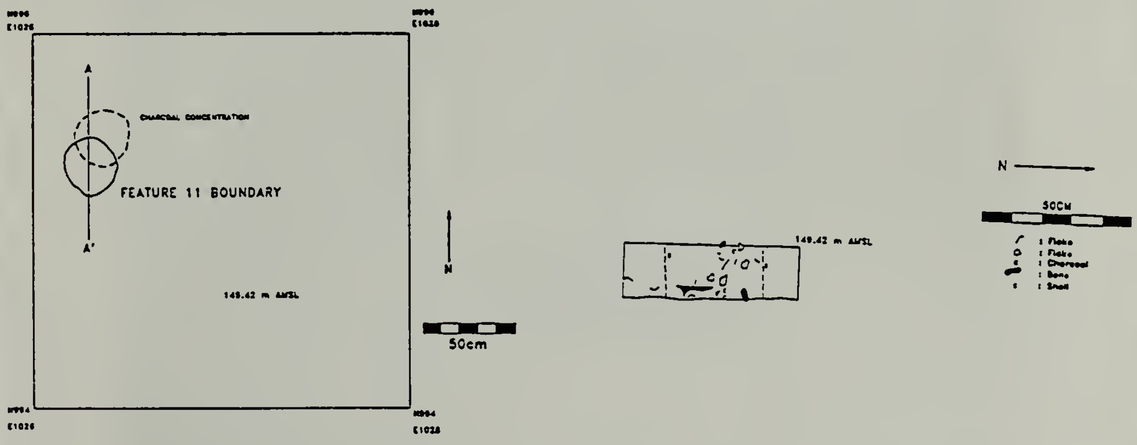


Figure 6.11 Feature 11 N994/E1026 plan map, west profile map.

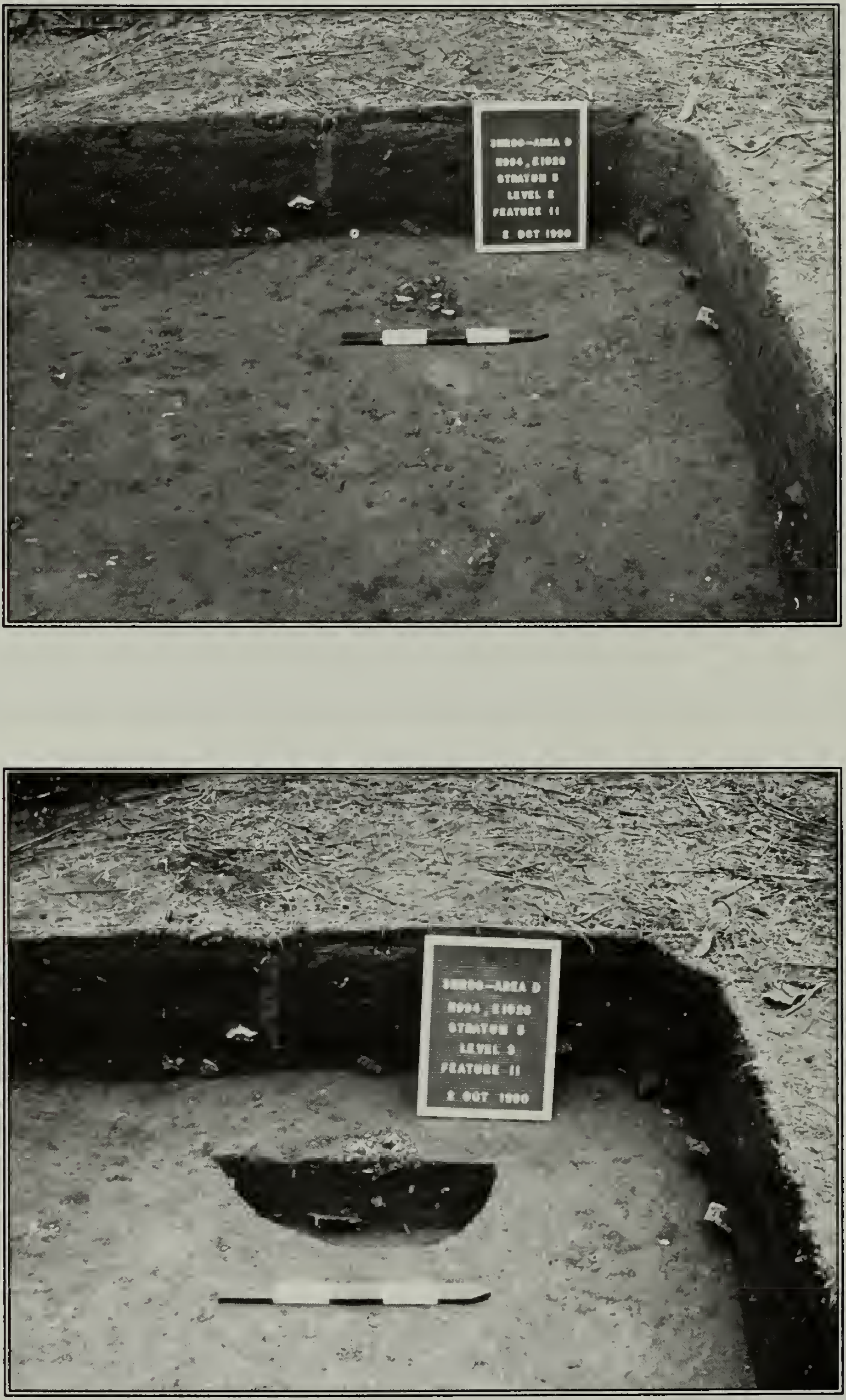


Figure 6.12 Feature 11. Top, unexcavated; Bottom, east half removed (AAS Neg. # 905202, 905206).

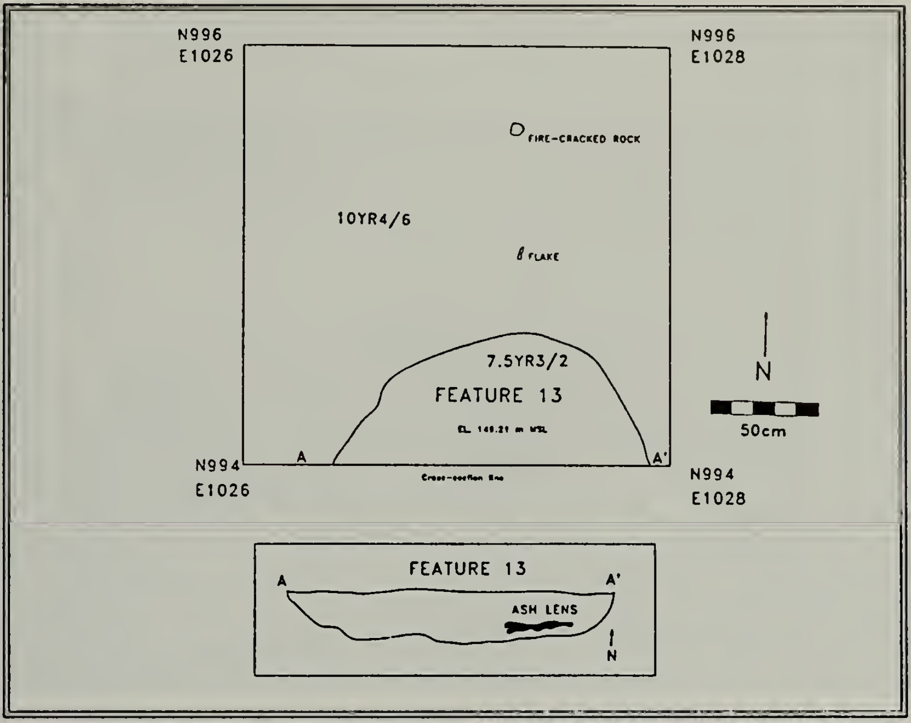


Figure 6.13 Feature 13 north profile map, N994/E1026 plan map.

Feature 14 This deep cylindrical pit was almost identical to Feature 4 discovered in 1988 at the base of the midden near the crest of the terrace. Feature 14 was recognized as a large amorphous smear of charcoal and artifacts at 149.04 m AMSL near the base of Stratum 5. The clearing of the feature smear resolved the outline of a circular core area (Figure 6.14) one meter in diameter. In profile, Feature 14 was a flat bottomed, cylindrical pit, 54 cm deep, intruding into Stratum 4 (Figure 6.14, 6.15). The excavators noted that the fill was stiffer and more compact than the general midden and that rocks in the fill were horizontal as if laid deliberately. The fill contained fire cracked rock, pottery, flakes, and very little charcoal though the fill was a darker organic stain than the surrounding Stratum 4 soils.

The profile of Feature 14 showed an outward flaring rim surrounded by a slight halo of charcoal flecks and gastropod shell mixed with midden soils. This flaring rim may indicate prehistoric re-excavation and reuse of the pit, while the smear of artifact laden soil capping the pit and adjacent to the edge is suggestive of trampling after it was sealed. The large volume (440 liters) and deep cylindrical shape indicate a storage function.

Feature 15 This feature is another flat bottom, basin shaped pit defined at 149.46 m AMSL. It was first recognized as a concentration of gastropod shells and darker charcoal enriched soils against the midden. The fill contained fire cracked rock, pottery, flakes, burned earth and bone as well as mussell and snail shell. Only about one quarter of the circular feature was exposed in the northwest corner of N996/E1028 (Figure 6.16, 6.17). The core of the feature had a radius of 75 cm under a smear of reddened earth and charcoal flecks that extended 35 cm south of the feature core edge. The flat bottom of the feature averaged 37 cm below the top of the feature (Figure 6.6) and intruded through Stratum 4 into Stratum 3.

The volume of the feature is 167.8 liters. If the excavated portion does represent one quarter of the pit, the volume of the whole feature would approach 672 liters, a truly huge feature for the site. Though small pellets of burned earth were included in the fill, no firing of the edges was observed. Such a large feature could have functioned as a storage pit that later was filled with trash.

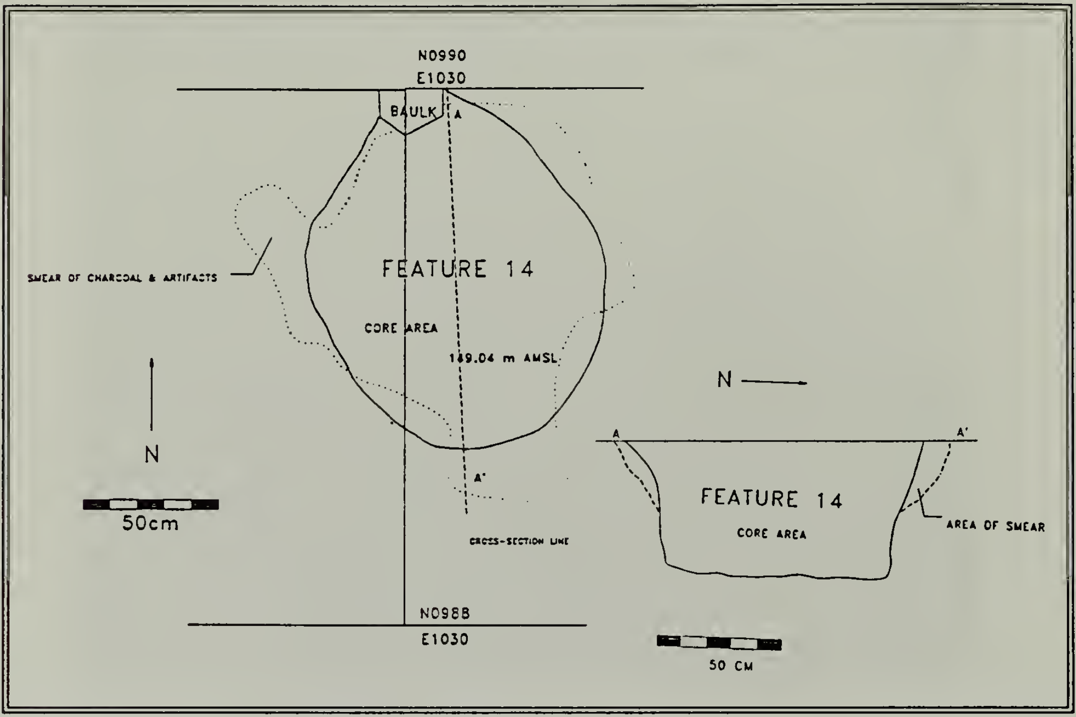


Figure 6.14 Feature 14 plan map, west profile map.

South and east of Feature 15 was an amorphous scatter of ash, burned earth and charcoal distributed across 80 cm of the 2m x 2 m unit (Figure 6.16). A profile face cut through the ash showed a discontinuous, amorphous lensing of ashy soil extending from the point of definition at 149.36 m AMSL to a depth of 149.21 m AMSL. The ashy soil had no definite edges as a feature, but appeared to be individual loads of ash, much like basket loading in a mound. The ashy area is interpreted as the dumping of individual loads of ash, possibly cleaned from a hearth in the midden.

Features 17, 19, 20 These three features are interpreted as postmolds. Feature 17 was clearly defined in profile in the south wall of the 1988 Backhoe Trench One and excavated in 1990. The point of origin in the midden could not be determined, but was identifiable at 149.27 m AMSL where the postmold extended through the base of the midden into Stratum 4. The diameter of Feature 17 was 16 cm at this point. Feature 19 and 20 were defined at 149.17 and 149.19m AMSL respectively. Feature 19 was 19 cm in diameter and Feature 20 was 16 cm in diameter. In plan view the stains were very light and when cross sectioned they had very ephemeral profiles. The Feature 19 profile showed very vague edges of the post extending to 24 cm below the point of origin (Table 6.1) where the bottom faded out. Feature 20 extended only 4 cm below the point of origin where it too faded. The size and especially the alignment with Features 17 and 11 indicate these features were part of a structure.

Other Features One thin, less than 3 cm deep, lens of dark soil was defined at the base of Stratum 5 in N988/E1028, that extended into the top of Stratum 4. This stain was assigned feature number 16 and mapped. When profiled against the south wall of the unit the feature was seen to be an undulation in the bottom of the midden and the darker nature of the soil was due to moisture retention.

A second large amorphous stain was mapped on the floor of N988/E1026 and given feature number 9. The unit floor was a mosaic of extremely varied soil textures at 40 cm below the surface near the bottom of

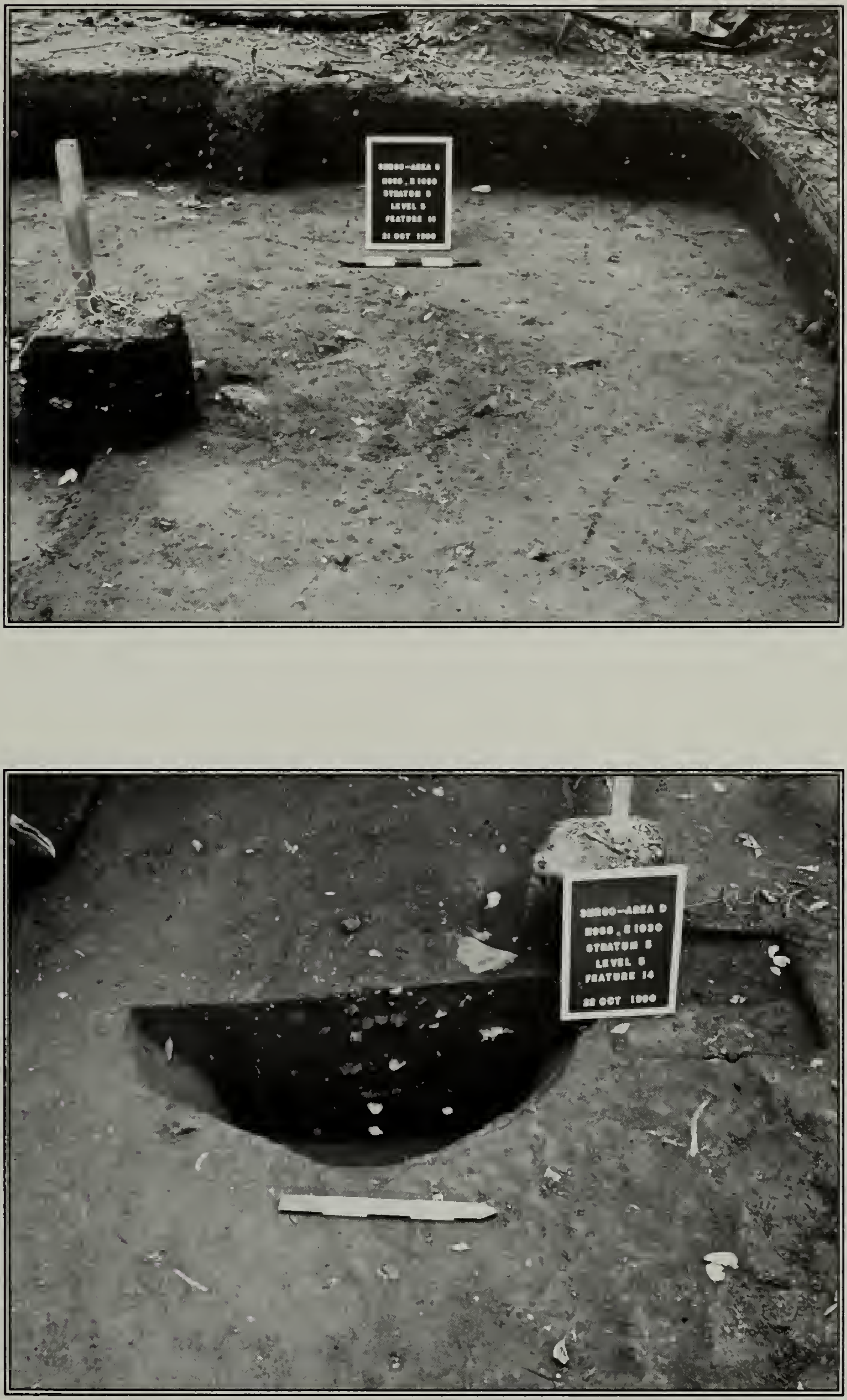


Figure 6.15 Feature 14, Top, Feature 14 unexcavated; Bottom, west profile exposed (AAS Neg. # 905549, 905555).

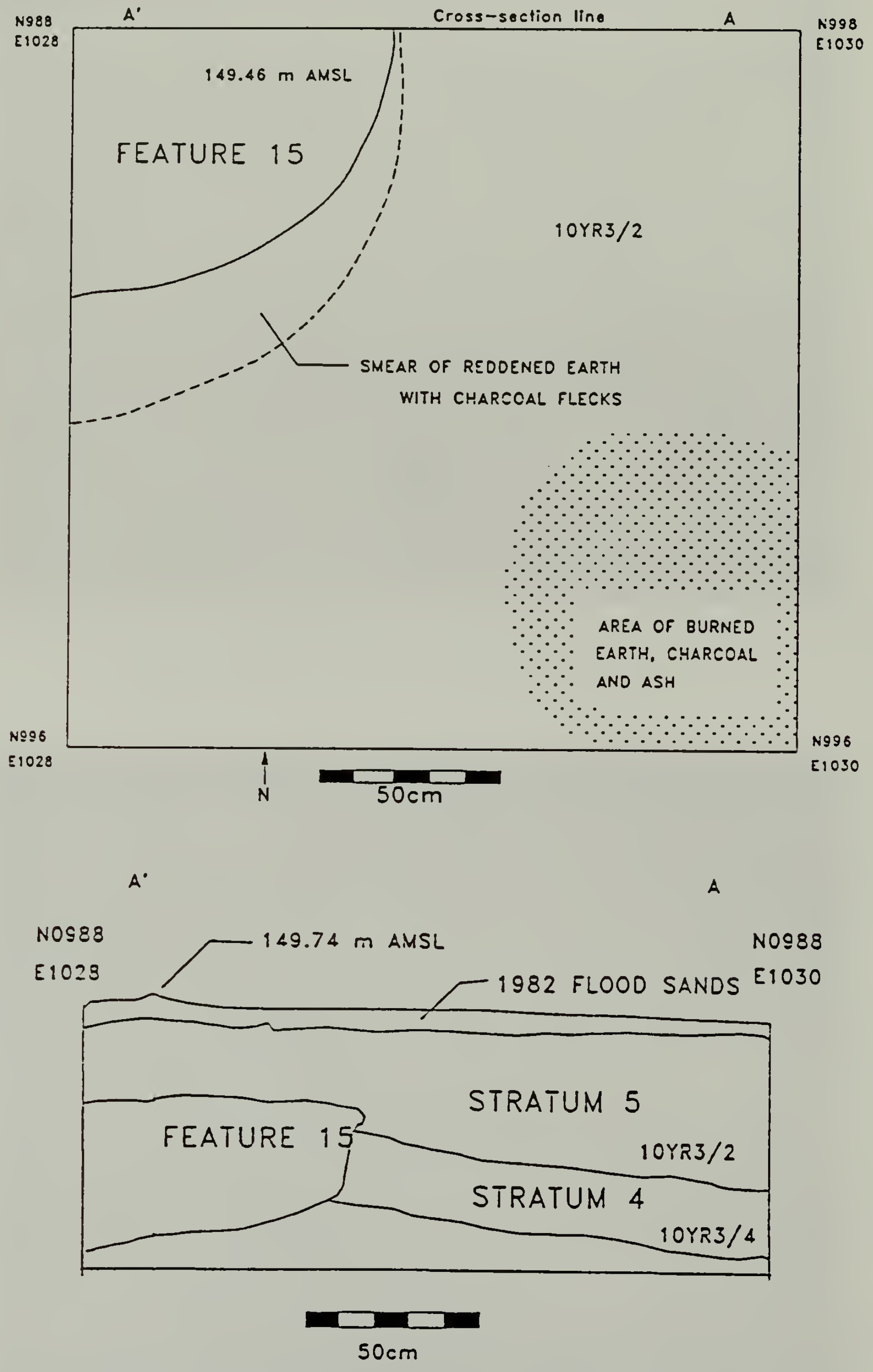


Figure 6.16 Feature 15 N996/E1028 plan map, north profile map.

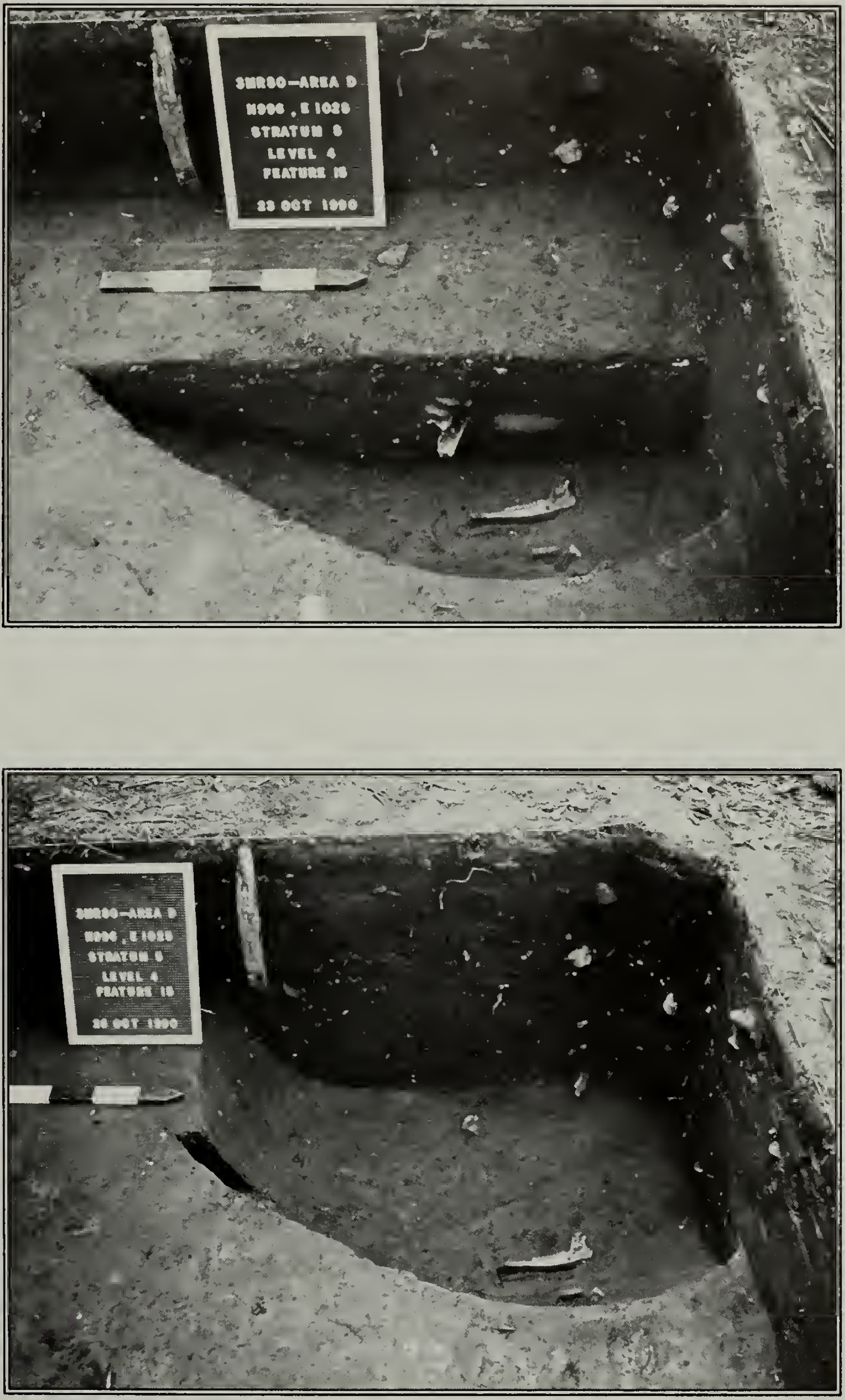


Figure 6.17 Feature 15 Top, feature half excavated; Bottom completely excavated (AAS Neg. # 905527, 905534).

Table 6.1 Feature Data

	Type	Elevation (m AMSL)	Diameter (cm)
Feature 11	Postmold	149.42 149.22	32
Feature 17	Postmold	149.27(?) 148.86	>16
Feature 19	Postmold	149.19 148.95(?)	19
Feature 20	Postmold	149.17 149.13 (?)	16
Feature 10	Hearth	149.22 149.17	110
Feature 13	Pit	149.21 148.97	150
Feature 14	Pit	149.04 148.50	100
Feature 15	Pit	149.48 149.09	75(150)

Stratum 5. The soils were rained on several times and dried differentially creating the impression of movable feature boundaries. Several rodent runs (at first thought to be postmolds continuing the arc because of their comparative size) were present in this level. Cross sectioning and excavation 13 cm deeper did not clarify the definition of the feature. The removal of a fifth and last level in Stratum 5 did not show a distinct feature profile in the south or east wall nor did artifact recovery help define the situation. Our conclusion was some natural disturbance, a tree or rodent burrow, confined to the central portion of the unit had occurred.

Settlement Pattern

One of the problems with excavating in thick midden deposits is the resolution of features within it. The recognition of features against a dark organic soil was accomplished here because of the high concentrations of artifacts in feature fill usually accompanied by pellets of burned earth. Features 10, 13, 14 and 15 were defined in this way and their upper limits are considered accurate. In contrast, postmolds were less clearly resolved.

Only Feature 11 seems to be accurately delineated, while Features 17, 19 and 20 are more problematic. The point of origin within the midden (Table 6.1) may not be accurate due to problems both in recognition and preservation within the midden.

Taken together, the four postmolds form an alignment that may be interpreted as part of the west wall and southwest corner of a rectangular structure measuring at least six meters in length (Figure 6.18). Assuming the upper limit of Feature 11 is accurately rendered, then Feature 15 and the ash dump would represent a

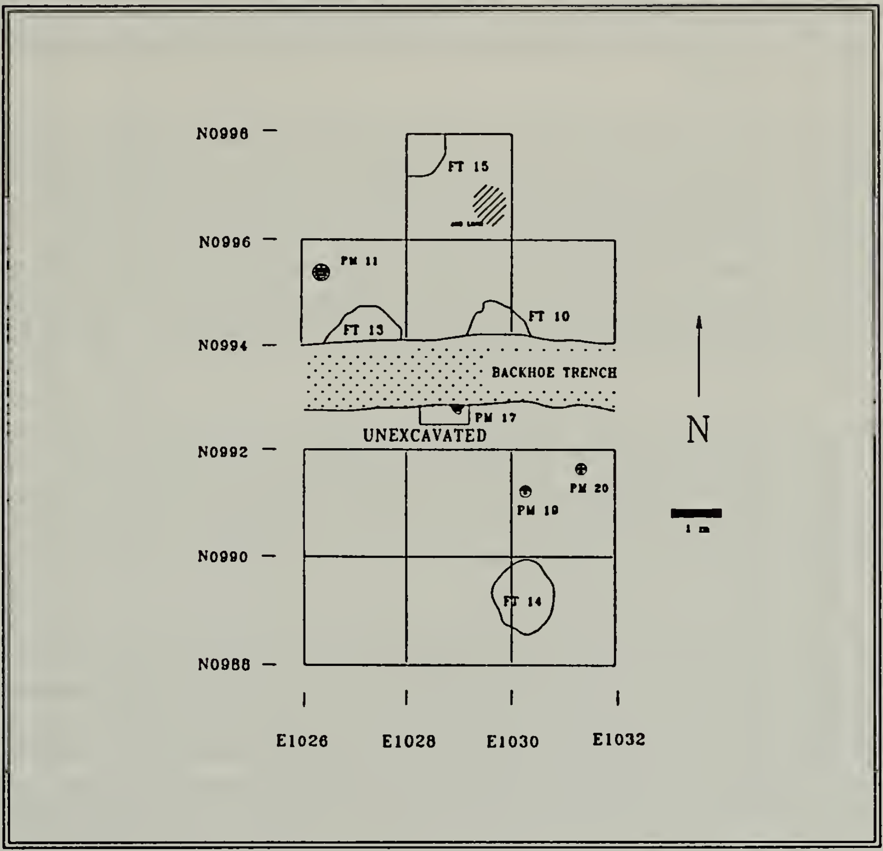


Figure 6.18 Feature distributions, Stratum 5.

Taken together, the four postmolds form an alignment that may be interpreted as part of the west wall and southwest corner of a rectangular structure measuring at least six meters in length (Figure 6.18). Assuming the upper limit of Feature 11 is accurately rendered, then Feature 15 and the ash dump would represent a contemporaneous pit feature inside the house. Feature 10 and 13 would predate the house on stratigraphic grounds (Feature 13 would hardly have been useful in a wall). Feature 14 does not appear to be immediately related to the house cluster and probably predates it.

Chronometry

One of the goals of the 1990 excavation at the Dirst site was to refine chronological assessments of the lower midden area made as a result of the 1988 investigations (Sabo et al. 1990:133-137). As in the previous investigation, careful consideration was given to the selection of charcoal samples for radiocarbon dating. Datable samples were selected only from contexts that suggested a high probability of representing a single event in the occupational history of the site. General midden samples were ruled out given the inherent problems of post-depositional mixing resulting from later occupations in the midden (Sabo et al. 1990: 135). The best contexts for dating were the pit features which represented sealed contexts. All of the features encountered were within the Stratum 5 midden.

Charcoal samples from three pits, Features 13, 14 and 15, were selected for dating. All three features were from different elevations within the midden. None displayed internal stratification indicating natural infilling that might have exposed the pits contents to a long period of exposure. The observations of the excavators indicated that the features were probably filled in a single event. Furthermore, Susan Scott's analysis of the faunal remains from these pits (Chapter 8) corroborates the supposition that the contents of these features represent single events. The features were also selected on the presence of sufficient quantities of charred nut fragments to submit for dating purposes. Nut charcoal was chosen over wood charcoal as most likely representing a single seasons crop. Nuts would have been gathered and utilized quickly as they are not storable on an open site for very long (Hilliard 1980; 1986).

The three samples were sent to Beta Analytic, Inc. of Coral Gables, Florida, who dated the 1988 material, and the results are presented in Table 6-1. The results are reported in radiocarbon years before present (RCYBP), by convention calculated from A.D. 1950. Genus and species identification was made by Susan Dunavan of the University of Michigan Museum of Anthropology, Ann Arbor as part of her botanical study in this report. A single Accelerator Mass Spectrometry (AMS) date was also run on the 1988 maize sample from Feature 4 to directly date the botanical remains themselves. A single sample of all the maize from the feature was submitted to Geosciences Management Institute, Boulder City, Nevada for assay. The results are presented in Table 6.1 below.

The Feature 13 charcoal sample (Beta-47831) was a composite of Hazelnut, Black Walnut, Hickory and unspecified hickory or walnut fragments (identified to the genus Juglandaceae) chosen from the light fraction flotation of pit fill. The sample weight was 8.4g. The resulting date of 1280 RCYBP, when calibrated according to Stuiver and Pearson (1986:831) yields a date of A.D. 689 (1261 BP) with a range of A.D. 650-880 (one standard deviation). The date falls across the terminal portion of the Middle Woodland and well into the Late Woodland period in the Ozarks.

The second and third radiocarbon samples produced identical dates. The second date (Beta-47832) was also a composite of Hickory, Black Walnut, Acorn, Hazelnut and hickory or walnut fragments (Juglandaceae) from the east half of Feature 14. This pit was defined near the bottom of the Stratum 5 midden. The sample weight was 11.93g. The last charcoal sample (Beta-47833), came from Feature 15, a large pit near Feature 13. The sample was composed of Acorn, Hazelnut and hickory or walnut fragments (also Juglandaceae) and weighed 8.23g. Both samples dated to 1350 RCYBP and yielded a calibrated date of A.D. 663 (1287 BP) with a range of A.D. 610-775. Like the Feature 13 date, both of these dates span the terminal Middle Woodland and most of the Late Woodland period. All three dates were consistent with the two dates from Feature 4, and consistent with each other.

Table 6.2 Results of 1990 Radiocarbon Dating Analysis

Lab No.	FSN	Provenience	C14 Age (RCYBP)	Calibrated Age*
Beta-47831	145	Feature 13	1280 +/- 100 BP	1261 BP (1300-1070) A.D. 689 (650-880)
Beta-47832	202	Feature 14	1350 +/- 100 BP	1287 BP (1340-1175) A.D. 663 (610-775)
Beta-47833	228	Feature 15	1350 +/- 100 BP	1287 BP (1340-1175) A.D. 663 (610-775)
Geo-08291		Feature 4	1009 +/- 57 BP	1010 BP (970-915) A.D. 1015 (979-1034)

* After Stuiver and Pearson 1986

The 1988 dates were from two features, one located within the midden dated to A.D. 1217 and one located at the base of the midden dated to A.D. 405-642. This led to the expectation that the midden itself was an accretional feature. A natural assumption would be that the midden built slowly, roughly between the date ranges represented by the two features excavated in 1988. The three new dates do not support this assumption, indeed they indicate the midden developed over a relatively short period of time.

The internal consistency of the expanded suite of dates is also consistent with the presence of a uniform assemblage of diagnostic artifacts throughout the midden, as well as in the features themselves. The majority of diagnostic artifacts are Scallorn arrowpoints, Rice Side Notched dartpoints and both grog and shell tempered ceramics. The concordant dates from Features 13, 14 and 15 also indicate they were probably built within a fairly short time span. Most importantly, all four of the features dated to the seventh century A.D. contained carbonized maize. If we accept the dates as generally correct, then one important finding of the excavations at the Dirst site is the apparent introduction of maize as a nonceremonial component of an assemblage of garden produced foodstuffs built around the older cultigens of the Eastern Complex earlier than the A.D. 800 watershed date for maize production commonly accepted by archeologists (Smith 1986).

To test this hypothesis, maize from the 1988 excavation of pit Feature 4 was submitted for radiocarbon dating. The AMS assay yielded a date of 1009 RCYBP (Geo-08291 Arkansas) calibrated to A.D. 1015 (1010 BP) with a range of A.D. 979-1034. This date is three hundred years later than we had expected, in light of the tight concordance of five radiocarbon dates from four Middle/Late Woodland pit features (4, 13, 14 and 15) in the midden. The large amounts of mussell and snail shells in the midden may have introduced fossil carbonates into the samples. However, if this were the case we would expect randomly varying dates, among all of the submitted samples, which we did not observe. This leaves two alternatives to consider: 1) that the date is simply wrong or 2) that the small maize sample in Feature 4 is intrusive from a later (A.D. 979-1034) context above or nearby the Feature 4 area. Given the concordance of the other five radiocarbon dates our inclination is to favor the rejection of the AMS date. In any case, AMS dating of additional maize samples from Features 13, 14 and 15 is needed to further explore the question of when maize was adopted as a garden cultigen in the central Ozarks.

CHAPTER 7

Archeobotanical Remains from the 1990 Excavations at 3MR80-D Buffalo National River, Arkansas

SANDRA L. DUNAVAN

Introduction

The opportunity to increase the sample of archeobotanical materials from the 1988 excavations enhances our data on early Late Woodland plant utilization in Ozark Highlands in qualitative as well as quantitative ways. Several species not found in the previous analysis were recovered, and some of the patterns described by Fritz (1990) have been altered by both the recovery of new species and differing quantities of species and categories of remains. These interpretative changes attest to the biases inherent in the archeobotanical record (Miksicek 1987) and the advantage afforded by numerous samples, especially from different feature contexts. The basic issues to be examined remain those described by Fritz (1990:153, 174): How much did people living in the Ozark uplands cultivate the native, starchy seed crops? How much did they rely on wild, collected resources? Was the adoption of maize in this area similar to that described for other parts of the Midwest and Midsouth? And how can we use the botanical remains from this site in models of regional and temporal patterns of population change, subsistence change, and agricultural intensification?

Light fractions from 32 flotation samples from five features, one of the 2x2 m test units, and the living floor -- all in Area D of the Dirst site (3MR80) -- were examined for this analysis. A total of 782.2 liters of feature fill, 250 liters of stratigraphic samples in N996 E1028, and 175 liters of living floor samples constituted the 1207.2 liters floated and discussed here. Fritz (1990) reported that carbonized wood, nut remains, plant stems, seeds, rinds, fungi and a large assortment of nonbotanical remains (including bone, shell, and chert) were recovered in the flotation samples from the 1988 excavations, and these categories were again recovered in the samples from 1990. Botanical remains are listed in Tables 7.1 through 7.4, and non-botanical remains are tabulated in Table 7.6.

Laboratory Methods

All samples were analyzed at the University of Michigan Museum of Anthropology's Ethnobotanical Laboratory. After an initial weighing, the samples were gently poured through a series of geological sieves (ranging from 5.6 to 0.425 mm in size) to facilitate sorting. All materials over 2 mm in size were weighed and counted (with the exception of modern botanical contaminants), and all cultigen fragments and all seeds, stems, rinds, and fungi were collected and counted from the fractions from 2 to 0.425 mm in size. Acorn and hazelnut shell were also collected, counted, and weighed in the sieves from 2 to 1.18 mm in size. The residue of other botanical remains, bone, shell, and stone less than 2 mm in size (but larger than 0.71 mm), which was not separated from the remaining soil matrix, was also weighed and is shown in Table 7.6 along with the weights of various non-botanical materials of interest over 2 mm in size. The weights of seeds, fungi, rinds, and stems (all of which generally weighed less than 0.01 g) were not recorded. Only carbonized plant materials were assumed to be of prehistoric origin and are described here.

Table 7.1 Wood recovered from flotation samples from 1990 excavations at 3MR80.

Provenience count & (weight)	F.10	F.11	F.13	F.14	F.15	N996 E1028	Living Floor	Totals	Samples with Presence	% of Wood Id'ed
Volume (liters)	12.1	25.1	153.3	423.9	167.8	250.0	175.0	1207.2		
Acer sp. (maple)	-	-	-	1 0.05	1 0.13	-	-	2 0.18	2	0.4 (1.5)
Carya sp. (hickory)	-	1 0.03	1 0.02	2 0.12	4 0.21	2 0.02	13 0.26	23 0.66	14	4.4 (5.4)
Fraxinus sp. (ash)	-	-	1 0.03	5 0.17	-	-	1 0.02	7 0.22	4	1.3 (1.8)
Gymnocladus/Gleditsia spp. (locust/coffeetree)	-	-	-	1 0.02	-	-	-	1 0.02	1	0.2 (0.2)
Ilex sp. (holly)	-	-	-	-	-	-	2 0.02	2 0.02	2	0.4 (0.2)
Juglans sp. (walnut)	-	1 0.02	-	1 0.01	-	-	4 0.09	6 0.12	6	1.2 (0.2)
Juniperus sp. (cedar)	-	-	-	-	1 0.02	-	-	1 0.02	1	0.2 (0.2)
Pinus echinata (shortleaf pine)	1 0.01	-	-	3 0.14	2 0.02	1 0.01	4 0.06	11 0.24	9	2.1 (2.0)
Platanus occidentalis (sycamore)	-	2 0.03	3 1.11	-	-	1 0.01	8 0.08	14 1.23	9	2.7 (10.1)
Quercus spp. (oaks)	8 0.25	18 0.29	7 0.12	16 0.56	12 0.44	11 0.22	43 0.90	115 2.78	24	22.3 (22.8)
Subgenera: Erythrobalanus (red oaks)	-	-	2 0.04	1 0.02	5 2.14	2 0.02	-	10 2.22	5	1.9 (18.2)
Lepidobalanus (white oaks)	-	-	1 0.20	-	2 0.39	-	-	3 0.59	2	0.6 (4.8)
Ulmaceae (elm family)	-	1 0.02	-	1 0.03	1 0.10	1 <0.01	1 0.01	5 0.16	5	1.9 (1.3)
bark	-	-	1 0.02	-	1 0.08	-	-	2 0.10	2	0.4 (0.8)
diffuse porous	-	1 0.01	-	3 0.05	1 0.02	1 0.01	-	6 0.09	6	1.2 (0.7)
ring porous	27 0.41	16 0.21	4 0.06	24 0.70	10 0.17	50 0.35	131 1.07	262 2.97	30	50.8 (24.4)
unidentifiable	4 0.02	-	-	2 0.04	-	13 0.08	27 0.41	46 0.55	18	8.9 (4.6)
total wood id'ed	40 0.69	40 0.61	20 1.60	60 1.91	40 3.72	106 0.90	210 2.74	516 12.17	30	100.0 (100.0)
total wood recovered	1.13	2.46	11.59	25.15	44.72	1.67	5.71	92.40		-

Table 7.2 Nut remains from flotation samples from 1990 excavations at 3MR80.

Provenience	F.10	F.11	F.13	F.14	F.15	N996 E1028	Living Floor	1990 subtotal	1988 subtotal	Totals
Volume (liters)	12.1	25.1	153.3	423.9	167.8	250.0	175.0	1207.2	1842.9	3050.1
Species - counts & grams										
Carya spp.	2	117	366	750	289	28	91	1643	107	1750
(hickories)	0.01	2.23	6.02	8.35	5.00	0.29	1.04	22.94	0.99	23.93
Juglandaceae	2	37	89	292	155	10	50	635	1	636
hickory family	0.02	0.30	0.55	1.59	1.10	0.06	0.67	4.29	0.09	4.38
Juglans nigra	-	12	5	1	-	-	1	19	-	19
(black walnut)		0.65	0.15	0.11			0.02	0.93		0.93
Corylus americana	-	-	25	17	48	-	9	99	-	99
(hazelnut)			0.15	0.09	0.35		0.09	0.68		0.68
Quercus spp.	21	122	755	1227	1153	98	417	3793	445	4238
(acorns)	0.05	0.32	1.52	1.79	1.78	0.19	0.70	6.35	0.85	7.20
unidentifiable	-	-	2	-	-	-	1	3	1	4
nutshell			0.01				0.01	0.02	0.01	0.03
total nutshell	25	288	1242	2287	1645	136	569	6192	554	6746
	0.08	3.50	8.40	11.93	8.23	0.54	2.53	35.21	1.94	37.15
Quercus spp.	2	-	1	-	-	-	-	3	28	31
acorn nutmeat	0.06		0.04					0.10	0.55	0.65

All weights were recorded on an OHAUS digital electronic balance (to the nearest 0.01 g), and sorting was performed with a binocular microscope at magnifications from 10-30X. The identification of some species of wood necessitated the use of higher magnifications (from 40-400X) on a metallurgical microscope. Identifications were made using the comparative collection of modern and archeological plants in the Ethnobotanical Laboratory at the University of Michigan. All of the sorted and tabulated remains were stored in gelatin capsules and zinc tins for permanent curation by the Arkansas Archeological Survey.

Botanical Identifications

Wood. Although less fill was floated than in the previous excavation (1207.2 liters compared to 1842.9 liters from 1988), a great deal more wood charcoal was recovered in the samples from 1990. A total of 92.40g of wood charcoal over 2 mm in size was recovered, as opposed to the 24.91 g of wood recovered in 1988. As shown in Table 7.1, most of this wood (over 92%) was found in the features, especially in Features 13, 14, and 15. Wood density (the ratio of wood to soil for a standard 10 liter sample) ranged from 0.60 g/10 liter to 2.67 g/10 liter for features, while densities averaged only 0.33 g/10 liter for the N996 E1028 samples and 0.77 g/10 liter for the living floor samples. An examination of the samples from the different levels in N996 E1028 shows that only the living floor and the levels immediately below it (Levels 4-5) had appreciable amounts of wood (over 0.20 g/10 liter); most of the samples from this test unit had less than 0.05 g/10 liter sampled, like the samples (outside of Feature 4) Fritz described from 1988 (1990:166). Two samples from N996 E1028 completely lacked wood. Although wood may have been more likely to be preserved in features than in general midden or living floor (the ratio of fragments per gram in wood examined for identification shows that wood in features was generally larger), this cannot completely explain the disparity between wood densities in features and midden. Different patterns of waste disposal for wood, or differences in the utilization of wood in different seasons may account for this contrast (as proposed for faunal differences between features and midden by Scott in this volume) .

Although the amount of wood in the features and the midden and living floors varied a great deal, the same general suite of species was identified in all three contexts. Table 7.1 shows the wood taxa identified from each feature and the 2x2 unit and living floor, both by count and weight, along with the ubiquity of each taxon in the samples (n=30) and the percentage each taxon (by count and weight) contributes to the wood examined. Much of the wood could not be identified except as ring-porous, diffuse-porous, or unidentifiable wood (60.9% by count, or 29.7% by weight), due to its size and poor state of preservation. About 46% (by count) of the wood in features and over 70% of the wood from other contexts could only be placed in these general categories.

The wood that could be identified from 3MR80-D reveals some interesting patterns. First of all, oak and hickory are the most ubiquitous and abundant genera present. Oaks constitute about 24.8% (by count, or 45.8% by weight) of the wood examined and are present in every feature and all but six of the other samples with wood. Hickories make up a mere 4.4% (by count, or 5.4% by weight), but are present in almost half the samples examined. Sycamore, pine, walnut, ash, and elm were regularly found in small quantities, and maple, honey locust or Kentucky coffee-tree, cedar, and holly were also identified. Although it should not be automatically assumed that these percentages indicate the types of wood utilized at the site, since different species of wood do preserve differentially (pine would seem to be particularly vulnerable to increased fragmentation; see Lopinot 1984:128-132; Rossen and Olsen 1985), these percentages can serve as a starting point for comparison.

In a survey of modern vegetation records from the Buffalo River Valley, Limp and Smith (1990) found that oak-hickory forests were the most common vegetation type recorded, covering about half the area surveyed. Furthermore, GLO (General Land Office) surveys of the area surrounding 3MR80 that showed oaks constituted 59% of the witness and line trees noted (Limp and Smith 1990:44-45). Cedar glades were the next most common type of vegetation found, followed by floodplain forests (comprised of elms, ashes, maples, sycamores, birches, willows, and cottonwoods) and oak-pine stands. Pine made up about 22 % of the GLO witness and line trees recorded and hickory constituted about 5% of the total. In general, the wood identified from 3MR80-D does reflect dominant types of local vegetation.

Nut Remains. Nutshell and nutmeat remains identified from the features, the 2x2m test unit, and the living floor are shown in Table 7.2, along with a summary of the nut remains identified from the 1988 excavations. Hickory, walnut, nutshell in the Juglandaceae family (which may be either hickory or walnut), and the unidentifiable nutshell fragments listed in this table were all sorted from the sieves 2 mm or larger in size, as described in the methods section, while the counts and weights for acorn and hazelnut are comprised of all the shells larger than 1.18 mm in size. The same methods were used by Fritz (1990), although no hazelnut was recovered in the 1988 samples. The different strategy for the recovery of acorn and hazelnut is an attempt to compensate for the bias against the recovery of carbonized acorn and hazelnut shell, which fragments more readily than denser nuts like hickory or walnut (Lopinot 1984:110-114).

As in the 1988 samples, acorn was the most abundant and ubiquitous type of nutshell found, although hickory nutshell is far more likely to be preserved than acorn. Lopinot (1984:131-154) gives some conversion factors for nutshell fragmentation rates (based on experimental data) and the amount of nutmeat available in different genera of nuts, and his conversion factors for shagbark and mockernut hickory (averaged), hazelnut, black walnut, and white, red, and black oaks (averaged) have been applied to the nut weights (totals from 1990, excluding Juglandaceae) in Table 7.3, in order to show how much meat the fragmented shells of various genera may actually represent when differential fragmentation and nutmeat mass have been considered. Clearly, acorn was an important resource at 3MR80.

Like wood, nutshell is much denser in the features (ranging from 0.28 to1.4 g/10 liter sample, except for Feature 1, which contains only .07 g/10 liter) than in the midden samples or living floor. Densities for these contexts average a mere 0.02 g/10 liters and 0.14 g/10 liters, respectively.

Seeds, Cultigens, and Other Miscellaneous Botanical Remains

The other botanicals recovered from 3MR80-D are listed in Table 7.4. Since the seeds and cultigens are of special interest, the remains of this type recovered in 1988 are also shown in Table 7.5, as well as in a subtotal column in Table 7.4.

Seeds

Features 13, 14, and 15 had the greatest diversity of seeds, as well the greatest quantities. Even in the features, seed density was generally low (less than 2.0 seeds/10 liter sample). This pattern is similar to that reported from 1988 (Fritz 1990a:170).

Many of the same species recovered in 1988 were found in the 1990 samples, such as little barley (*Hordeum pusillum*), which was recovered mainly
from Features 14 and 15. A single caryopsis of this grain was found both in the living floor and in Level 6 of N996 E1028, however.

Two other cultigens from the native suite of starchy seed crops were recovered -- once again, the same species recovered in 1988. A single maygrass caryopsis (*Phalaris caroliniana*) was found in Feature 15, and three chenopods of the domesticated variety *C. berlandieri* var. *jonesianum* were recovered (one chenopod fruit was found in Feature 10, one in Feature 13, and one in Level 7 of N996 E1028). These chenopods all had the truncate margins characteristic of the domesticated variety (Smith 1985). Several other *C. berlandieri* fruits were found, especially in Features 13 and 14, but all were too distorted to distinguish the morphological features indicative of domestication.

Table 7.3 Nutweights and percentages (excluding Juglandsceae and unidentified nutshell) from flotation samples from 3MR80 and conversions using Lopinot (1984:131-151) conversion factors.

	weight (g)	%	converted weight (g)	converted %
Carya spp. (hickories)	22.94	74.2	72.63	51.2
Corylus americana (hazelnut)	0.68	2.2	3.23	2.3
Juglans nigra (black walnut)	0.93	3.1	4.48	3.2
Quercus spp. (acorn)	6.35	20.5	61.58	43.3
totals	30.90	100.0	141.92	100.0

Another native crop found was the common sunflower (*Helianthus annuus*). Two almost complete sunflower achenes and a large fragment of another were found in a sample from Feature 13. The two carbonized achenes only measured 6.1 x 2.5 mm and 5.4 x 3.8 mm (length x width), however, and even when corrected for the shrinkage from carbonization, these dimensions are too small to assign domesticated status to them (Heiser 1985), unlike the sunflower achene found in the 1988 sample, which measured 7.4 x 3.4 mm.

Some seeds not found in the samples from 1988 include an unidentified Compositae (sunflower family) seed, a hawthorn nutlet, tick trefoil, pokeweed, a plum stone, and an elderberry seed (see Table 7.4). Several seeds found in 1988 did not appear in the 1990 samples, such as *Polygonum erectum*
(cultivated knotweed, the other common native starchy seed), ragweed, spurge, seeds from the morning glory family, bearsfoot, and purslane. Given the generally low density of seeds, even in the features, it is not surprising that these seeds were not recovered from both analyses.

Maize. One of the most interesting aspects of the archeobotany from 1988 was the recovery of small amounts of maize, most of it from Feature 4 (Fritz 1990a:169-170). As Fritz points out, the recovery of low quantities of maize from flotation samples dating to the Middle Woodland and early Late Woodland period has been well-documented from a few sites in Ohio, Illinois, and Tennessee, but this is the first such pre-Mississippian maize recovered from a well dated context from Arkansas. The discovery of more maize kernel fragments and cupules

Table 7.4 Seeds, cultigens, and other miscellaneous botanical remains recovered from flotation samples from 1990 excavations at 3MR80.

Provenience	F.10	F.11	F.13	F.14	F.15	N996 E1028	Living Floor	1990 subtotal	1988 subtotal	Totals
Volume (liters)	12.1	25.1	153.3	423.9	167.8	250.0	175.0	1207.2	1842.9	3050.1
Amaramthus sp. (amaranth)	-	-	-	2	-	-	1	3	12	15
Ambrosia trifida (ragweed)	-	-	-	-	-	-	-	-	2	2
Chenopodium spp. (chenopods)	-	-	1	1	-	2	13	17	12	15
C. berlandieri	-		4	2	-	1	-	7	9	16
C. berlandieri var. jonesianum	1	-	1	-	-	1	-	3	1	4
Cheno-Am (chenopod or amaranth)	1	-	-	1	-	-	-	2	4	6
Compositae (sunflower family)	-	1	-	-	-	-	-	1	-	1
Convolvulacceae (morning glories)	-	-	-	-	-	-	-	-	4	4
Craetagus sp. (hawthorne)	-	-	-	-	1	-	-	1	-	1
Desmodium sp. tick trefoil	-	-	-	-	-	-	1	1	-	1
Diospyros virginiana (persimmon)	-	-	3	-	1	-	1	5	2	7
Euphorbia sp. (spurge)	-	-	-	-	-	-	-	-	3	3
Galium sp. (bedstraw)	-	-	2	2	2	-	-	6	3	9
Helianthus annuus (sunflower)	-	-	3	-	-	-	-	3	1	4
Hordeum pusillum (little barley)	-	-	-	6	7	1	1	15	62	77
Iva annua (sumpweed)	-	-	-	-	-	-	-	-	2	1
Leguminosae (bean family)	-	-	-	-	1	-	-	1	1	2
Phalaris caroliniana (sumpweed)	-	-	-	-	1	-	-	1	16	17
Phutolacca americana (sumpweed)	-	-	-	-	1	-	-	1	-	1

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Table 7.4 Seeds, cultigens, and other miscellaneous botanical remains recovered from flotation samples from 1990 excavations at 3MR80 (Concluded).

Provenience	F.10	F.11	F.13	F.14	F.15	N996 E1028	Living Floor	1990 subtotal	1988 subtotal	Totals
Volume (liters)	12.1	25.1	153.3	423.9	167.8	250.0	175.0	1207.2	1842.9	3050.1
Poacceae (grass family)	-	-	1	1	-	1	-	3	4	7
Polygonaccae (knotweed family)	-	-	-	-	2	-	-	2	2	4
P. erectum (erect knotweed)	-	-	-	-	-	-	2	2	12	15
Polymnia uvedalia (bearsfoot)	-		-	-	-	-	-	-	1	1
Portulaca oleracea (purslane)	-	-	-	-	-	-	-	-	9	9
Prunus americana (plum)	-	-	-	-	1	-	-	1	-	1
Rhus sp. (sumac)	-	-	1	2	1	-	2	6	1	7
Sambucus canadensis (elderberry)	-	-	1	-	-	-	-	1	-	1
Vitis sp. (grape)	-	-	-	6	1	1	2	10	7	17
Unknown seeds	-	-	-	1	-	-	-	1	39	40
unident. fragments	-	1	49	33	12	4	11	110	not	110+
seed total	2	2	66	57	31	11	19	188	199+	387+
Zea mays (maize) total fragments	-	-	-	50	27	-	-	77	37	114
kernal fragments	6	1	10	29	10	-	4	60	3	63
cupules & fragments	-	-	1	17	17	3	5	43	262	69
glumes	-	-	-	-	-	-	-	-	7	7
embryo	-	-	-	1	1	-	-	2	1	3
maize weight	0.03	<0.01	0.13	0.23	0.19	0.01	0.07	0.66	0.16	0.82
Cucurbita sp.(squash)	-	-	-	2	1	-	3	6	16	22
Arundinaria gigantea (cane stem)	-	-	-	-	-	-	8	8	37	45
dicot stem	-	1	5	-	-	-	-	6	1	7
monocot stem	-	-	-	1	-	-	3	4	-	4
pedicel (grape?)	-	-	1	1	1	-	-	3	-	3
fungi	-	-	1	3	5	1	5	15	5	20

Table 7.5 Seeds, cultigens, and miscellaneous botanical remains recovered from flotation samples from 1988 excavations at 3MR80. (Fritz 1990a).

Provenience	F.1	F.2	F.3	F.4	F.6	Living Floor	Stratum 5 Midden	Other Areas	1988 Subtotal
Volume (liters)	48.0	170.0	10.0	657.0	9.0	78.5	512.5	357.9	1842.9
Amaramthus sp. (amaranth)	-	-	-	10	-	-	1	1	12
Ambrosia trifida (ragweed)	-	2	-	-	-	-	-	-	2
Chenopodium spp. (chenopods)	1	2	-	8	-	-	-	2	13
C. berlandieri	1	6	-	2	-	-	-	-	9
C. berlandieri var. jonesianum	-	1	-	-	-	-	-	-	1
Cheno-Am (chenopod or amaranth)	-	-	-	3	-	1	-	-	4
Compositae (sunflower family)	-	-	-	-	-	-	-	-	-
Convolvulacceae (morning glories)	-	-	-	4	-	-	-	-	4
Craetagus sp. (hawthorne)	-	-	-	-	-	-	-	-	-
Desmodium sp. tick trefoil	-	-	-	-	-	-	-	-	-
Diospyros virginiana (persimmon)	-	-	-	1	-	-	1	-	2
Euphorbia sp. (spurge)	-	-	-	3	-	-	-	-	3
Galium sp. (bedstraw)	-	1	-	1	-	-	-	1	3
Helianthus annuus (sunflower)	1	-	-	-	-	-	-	-	1
Hordeum pusillum (little barley)	-	-	-	62	-	-	-	-	62
Iva annua (sumpweed)	-	-	-	2	-	-	-	-	2
Leguminosae (bean family)	-	-	-	-	-	-	-	-	-
Phalaris caroliniana (sumpweed)	-	-	-	14	-	-	1	1	16
Phutolacca americana (sumpweed)	-	-	-	-	-	-	-	-	-

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Table 7.5 Seeds, cultigens, and miscellaneous botanical remains recovered from flotation samples from 1988 excavations at 3MR80. (Fritz 1990) (Concluded).

Provenience	F.1	F.2	F.3	F.4	F.6	Living Floor	Stratum 5 Midden	Other Areas	1988 Subtotal
Volume (liters)	48.0	170.0	10.0	657.0	9.0	78.5	512.5	357.9	1842.9
Poacceae (grass family)	-	-	-	3	-	-	1	-	4
Polygonaccae (knotweed family)	-	-	-	1	-	-	-	1	2
P. erectum (erect knotweed)	-	-	-	2	-	-	-	-	2
Polymnia uvedalia (bearsfoot)	-	-	-	-	1	-	-	-	1
Portulaca oleracea (purslane)	-	-	-	9	-	-	-	-	9
Prunus americana (plum)	-	-	-	-	-	-	-	-	-
Rhus sp. (sumac)	-	-	-	-	-	-	1	-	1
Sambucus canadensis (elderberry)	-	-	-	-	-	-	-	-	-
Vitis sp. (grape)	-	2	-	4	-	-	1	-	7
Unknown seeds	3	3	-	25	1	-	1	6	39
seed total	6	17	-	155	1	1	7	12	199
Zea mays (maize) total fragments	-	-	-	35	-	1	-	1	37
kernal fragments	-	-	-	3	-	-	-	-	3
cupules & fragments	-	-	-	24	-	1	-	1	26
glumes	-	-	-	7	-	-	-	-	7
embryo	-	-	-	1	-	-	-	-	1
maize weight	-	-	-	0.14	-	0.01	-	0.01	0.16
Cucurbita sp.(squash)	1	6	-	9	-	-	-	-	16
Arundinaria gigantea (cane stem)	-	14	-	22	-	-	-	-	37
dicot stem	-	-	-	1	-	-	-	-	1
monocot stem	-	-	-	-	-	-	-	-	-
pedicel (grape?)	-	-	-	-	-	-	-	-	-
fungi	-	-	-	3	-	-	2	2	5

Table 7.6 Non-botanical remains from flotation samples from 1990 excavations at 3MR80.

Provenience	F.10	F.11	F.13	F.14	F.15	N996 E1028	Living Floor
Volume (liters)	12.1	25.1	153.3	423.9	167.8	250.0	175.0
Bone (g)	-	1.75	12.04	14.42	3.34	0.16	4.3
Chert (count)	2	46	195	277	68	9	90
(g)	0.01	1.98	7.48	7.21	1.84	0.08	14.44
Snailshell (g)	0.28	2.56	9.10	103.78	48.62	5.24	20.37
Mollusce shell (g)	-	-	1.51	1.58	0.36	-	-
Unknown (count)	8	6	42	26	40	5	11
(g)	0.04	0.04	0.30	0.20	0.33	0.02	0.07
Residiue (g)	8.50	35.91	75.98	356.68	202.18	96.89	218.56
Stone/soil (g)	12.09	51.27	45.15	531.66	286.28	356.32	810.72

in all of the features excavated in 1990 and in N996 E1028 and the living floor samples, albeit in low quantities, confirms Fritz's conclusion that maize was adopted in the Ozarks no later than in other areas in the midcontinent. The fact that it was found in such low quantities suggests that maize did not dominate the subsistence economy, as it later came to do. Given the small amount of maize recovered from the features, it is doubtful that a less intensive sampling strategy (such as the flotation of a single 10 liter sample from each feature) would have recovered any maize at all.

Even though more maize was recovered from the 1990 samples, most of these kernels and cupules are so highly fragmented it is difficult to characterize its morphology. Cupule widths (measuring from one cupule wing to the other, along the diameter of the cob) and cupule heights (corresponding to kernel thickness, paralleling the long axis of the cob) on the most complete specimens were 4.5 x 1.4 mm, 4.8 x 1.5 mm, 4.0 x 2.0 mm, 4.2 x1.7 mm, and 4.5 x 1.7 mm (mean measurements are 4.4 x 1.7). These measurements are not dissimilar from those from the nearly contemporaneous Sponemann site in the American Bottom of west-central Illinois, where cupule size averaged 4.6 x 2.4 mm (Parker 1990).

***Cucurbita* sp. Rind.** Charred rinds of squash or gourd, probably domesticated *Cucurbita pepo*, were found in two samples from the living floor and in Features 14 and 15. All of the fragments recovered measure less than 1.5 mm in thickness, but the inner surfaces of the rinds have been eroded, so wall thickness cannot be gauged.

Miscellaneous Botanical Remains. Several more fragments of cane (*Arundinaria gigantea*) were recovered from the living floor samples, and some unidentifiable plant stems (both monocotyledonous and dicotyledonous) were found in Features 13, 14, and 15. Three pedicels with peduncles, or stems with fruit attachments, were also found in these three features, and although they seem very similar to grape pedicels (and grape seeds were found in Features 14 and 15), their identification could not be certain. Small fragments of carbonized fungi, like those commonly found on decaying leaf matter, were found in many samples (shown in Table 7.4).

Discussion. The contents of these flotation samples, especially when taken in context with those described by Fritz (1990), provide some insight into a period of changing subsistence economy in the Ozark Highlands. Clearly, maize was cultivated along with several native starchy seed crops, such as chenopod, little barley, and possibly knotweed and maygrass. Since the latter two seeds were only found in trace amounts, evidence for their cultivation is weak, but they are known to have been important crops in other parts of the Ozarks (Fritz 1986).

Sumpweed or marsh elder *(Iva annua)* was found in the 1988 samples, and sunflower was found in both sets of samples. Both may have been cultivated at the Dirst site, although the sunflower achenes recovered from the 1990 excavation were rather small for a domesticate. Squash (*Cucurbita* sp.) is another well-known cultigen that was clearly grown by the site's inhabitants.

Although maize was found in low quantities, it was found consistently in several different contexts, indicating that its use was not rare. Other resources, especially acorns, however, may have been more intensively used as a starchy food. Hickory nuts too seem to have been an important collected resource, given their abundance in the features analyzed from 1990, although they were not so common in the samples from 1988.

The most common type of fruit found, presumably collected from near the site, was grape. Other plants, such as plum, elderberry, purslane, persimmon, sumac, hawthorn, and amaranth were also undoubtedly collected, although the evidence for their use is not quite as abundant.

As Fritz (1990:175) concludes, it seems that "gardening and harvesting practices were on a parallel if not common pathway with those of contemporary societies" elsewhere in the midcontinent. The roles that these practices and the resources seen here, both wild and domesticated, played in the cultural changes proposed for this period of prehistory remain to be explored.

CHAPTER 8

Zooarcheological Remains, Lower Midden Area

SUSAN L. SCOTT

During the second season of excavation at the Dirst Site (3MR80-Area D), well over 10,000 identifiable animal bone fragments were recovered. Budgetary constraints necessitated sampling of the total assemblage, restricting the second round of faunal analysis to the vertebrate remains from five Late Woodland pit features. As was true of the 1988 sample, bone preservation was excellent, with no evidence of marked post-depositional attrition. Although only five features were analyzed for the following report, the 1/4" fraction of material from these features yielded over 4500 bone fragments, 3845 of them identifiable at least to taxonomic class. Eleven new taxa were present in this sample of Late Woodland household refuse, bringing the total number of mutually exclusive taxa identified to date to 42 (Table 8.1).

The following analysis will present part of the results of the present study separately, and part in combination with like-aged samples from the 1988 excavation of the same site. Basic information -- NISP (Number of identified specimens), weight (in grams) and MNI (Minimum number of individuals) -- are presented by feature for this second dataset in Table 8.2. The remaining tables combine data compiled for recently analyzed samples with previously analyzed Late Woodland deposits, referred to in Scott (1990) as Late Woodland, Midden, and Stratum 5 in published tables. Analyzing the present sample separately was briefly considered, but was determined to be more relevant to matters of taphonomic interest (juxtaposition of feature versus general midden fill) than anthropological questions more general in scope.

Materials and Methods

Bone fragments from the Dirst site were identified by comparison with specimens in the author's reference collection, or collections made available by the University of Southern Mississippi, or the Natural History Museum at the University of Georgia. Data recorded include taxon (to the most specific level possible given the surviving morphological characteristics of the fragment), element, symmetry, degree of epiphyseal fusion, modification (burning, gnawing, butchering marks), and weight (in grams). For large mammal and deer remains, degree of fragmentation was recorded in addition to the other variables, and for identifiable fish, length of the individual was estimated. All deer teeth were aged with reference to descriptions in Severinghaus (1949).

Although examination of fine screen samples from the Dirst site no doubt would have been informative, only the 1/4" fraction of bone was analyzed for this report. Cursory examination of the light fraction from both column samples and features confirmed the presence of additional fish remains (largely scales) only in the latter depositional context (R. Guendling, personal communication). Overlooking the fine screen material has therefore underestimated the importance of fish as a resource during the Late Woodland period. However, analysis of only feature contexts during this second phase of analysis has offset this skewing to an unknown extent, as will be discussed below.

Taphonomy

As was true for the 1988 sample of bone, most bone fragments from the second sample were permineralized, presumably as a result of mineral-rich groundwater. The limestone bedrock underlying these

Table 8.1 Species list for faunal remains from 3MR80D*

Common name	Scientific name
Raccoon	Procyon lotor
Striped skunk	Mephitis mephitis
Mink	Mustela vison
Grey fox	Urocyon cinereoargenteus
Dog	Canis cf. familiaris
Rabbit	Sylvilagus sp.
Cottontail	S. floridanus
Squirrel	Sciurus sp.
Gray squirrel	S. carolinensis
Fox squirrel	S. niger
Chipmunk	Tamius striatus
Pocket gopher	Geomys bursarius
Woodchuck	Marmota monax
Beaver	Castor canadensis
Muskrat	Ondatra zibethcus
Mouse/Rat	Cricetidae
Unid. rodent	Rodentia
Whitetail deer	Odocoileus virginianus
Elk	Cervus canadensis
Turkey	Meleagris gallopayo
Snapping turtle	Chelydridae
Mud/musk turtle	Kinosternidae
Softshell turtle	Apalone sp.
Aquatic turtle	Graptemys/Pseudemys/Trachomys
*Map turtle	Graptemys sp.
Slider	Chrysemys concinna
Box turtle	Terrapene sp.
Non-poinsonous snake	Colubridae
Racer/Coachwhip	Coluber/Masticophis
"Kingsnake"	Lampropeltis/Elalphe
*Kingsnake	Lampropeltis sp.
*Garter snake	Thamnophis sirtalis
*Water snake	Nerodia sp.
?Pinesnake	cf. Pituophis melanoleucus
Frog/Toad	Anura
*Bullfrog	Rana catesbeiana
Gar	Lepisosteus sp.
*Gizzard Shad	Dorosoma cepedianum
Minnow	Cyprinidae
Sucker	Catostomidae
*Carpsucker	Carpiodes sp.
Hogsucker	Hypentelium nigricans
Redhorse	Moxostoma sp.
Catfish	Ictaluridae
Channel catfish	Ictalurus punctatus
*Brown bullhead	Ictalurus melas
Flathead catfish	Pylodictis olivaris
Spiny-ray fish	Perciformes
Sunfish (family)	Centrarchidae
Bass	Micropterus sp.
*Smallmouth bass	Micropterus cf. dolomieu
Sunfish	Lepomis sp.
?Rockbass	ct. Ambloplites rupestris
*Sauger	Stizostedion sp.
Freshwater drum	Aplodinotus grunniens

*Taxa identified from samples analyzed for this report. Not previously recorded.

archeological deposits coupled with a thick blanket of alluvium no doubt created excellent postdepositional conditions at the site. Non-acidic pH and relatively uniform groundwater conditions provided a stable postdepositional environment unlikely to destroy buried bone at this site for many years to come.

Gnawed bones were recovered from Features 14 and 15, the two largest samples in this second collection. Feature 14 yielded ten carnivore-gnawed bones identified as deer and large mammal: the proximal end and distal shaft of two humeri, a distal radius, an ilium and an ischium fragment, two femur fragments -- shaft and proximal end, a proximal metatarsal, and three unidentifiable large mammal longbone shaft fragments. Two of these fragments, the femur shaft and an unidentifiable longbone also exhibited rodent gnawing. The culprit for the latter may be an intrusive pocket gopher (Geomys bursarius) represented by articulated right and left maxilla in Feature 14. Only carnivore gnawed deer bone, a proximal tibia and distal second phalanx, were recovered from Feature 15. The frequency of carnivore gnawed bone in this sample overall, 12 of 3844 fragments, is much higher than in the 1988 sample, which produced only four of 7442 fragments. The presence of these marks on bones in feature deposits suggests that the deposits are comprised of refuse removed only periodically from living areas. The extent to which dogs reduced the bone assemblage at the site is impossible to assess.

Because the present sample of bone came only from pit features, as opposed to general midden fill, it may have been affected by pre- and post-depositional taphonomic factors of a somewhat different order than the 1988 assemblage. The latter assemblage was comprised of both feature and non-feature fill, with general midden fill contributing ca. 52% of the total number of identified fragments (NISP). In comparing the analyzed samples from the two excavations, the major differences between them are the relatively greater diversity of and equitability among different taxonomic groups in the 1990 "feature only" deposits (Table 8.3). The quantitative contribution of large mammals (deer, elk, ?bear) to the total assemblage is lower in features, although they far and away dominate both kinds of deposits. Most other taxonomic groups -- small mammals, turtles, snakes, and fish -- are relatively better represented in features. Closer examination of the content of a large Late Woodland feature excavated and analyzed in 1988 (Feature 4) corroborates this general pattern. Since Feature 4 contributed 36% of the 1988 Late Woodland sample (NISP), without its inclusion offsetting the differences typical of the two kinds of deposits, the discrepancies in Table 8.3 would be even more pronounced.

Why are feature samples quantitatively and qualitatively different from general midden fill? The source of this difference could be cultural or natural in origin. Because many of these pit features probably served originally as storage receptacles, they would most likely have been empty and thus available initially for receiving household refuse in the late spring, a time of year that may well have coincided with spawning runs from the White into the Buffalo River. Three of the five features analyzed for the second field season (Features 13, 14, and 15) produced remains of near-term deer fetuses or newborn deer definitely younger than 1 month of age. In northwest Arkansas, these young deer, or their mothers, probably were killed in the spring (late March to early June is the period during which most fawns are born in northern Arkansas today according to Sealander 1979:257-260). The single spring season indicator recovered during the 1988 field season, a buck frontal with recently shed antlers, also was recovered in feature fill (Feature 3), further corroborating the inference that bias in pit content may be at least partially cultural (seasonal) in nature.

Before a cultural explanation for this pattern can be wholeheartedly embraced, however, natural taphonomic factors affecting preservation must be ruled out. Following deposition, refuse thrown into these pit features was cushioned from trampling (thereby at least potentially being subjected to relatively less mechanical attrition postdepositionally), and was better protected from radical changes in temperature and moisture regimes than bone in surface deposits. Although to my knowledge density profiles have not yet been developed for taxa other than large mammals (e.g. Binford and Bertram 1977; Lyman 1984), field studies of differential weathering in surface deposits suggest higher rates of dissolution differentially destroy bones of small animals, including small mammals, birds, turtles, fish, etc. (Gifford 1987). Experimental studies have confirmed that fish bone is less resistant to breakage than mammal bone (Wheeler and Jones 1989:63). The same general statement can be asserted for bird bone: as an experienced zooarchaeologist and a pet owner oft cautioned not to feed chicken bones to dogs for fear the splinters might damage their digestive tract, I think it is safe to say that bird bone, like fish bone, is exceptionally brittle.

Table 8.2 Feature Data Number Identified specimens (NISP), Weight (in grams), Minimum Number Individuals (MNI). Numbers in parentheses refer to charred bone.

	Feature 10			Feature 11		
Taxon	NISP	g	MNI	NISP	g	MNI
Raccoon						
Skunk						
Cottontail						
Squirrel						
Fox squirrel						
Grey squirrel						
Pocket gopher						
Rat						
Beaver						
Muskrat						
Deer	2(1)	1.7	1	10	29.1	2
Deer antler						
Wapiti	1	29.6	1	1(1)	3.3	1
very lg mam	1	1.1	-	2(2)	2.4	-
lg mammal	37(16)	15.1	-	40(16)	31.8	-
sm/med mam	10(8)	1.8	-	3	1.8	1
TOTAL MAMMAL	51(25)	49.3	2	56(19)	68.4	4
Turkey				1	1.4	1
Lg bird	1	0.1	1	11	5.2	-
Med/sm bird	3(1)	0.5	1			
TOTAL BIRD	4(1)	0.6	2	12	6.6	1
Snapping turtle (family)						
Mud/musk turtle (family)	1	0.2	1			
Softshell turtle (family)						
Box turtle				1	1.9	1

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Table 8.2 **Feature Data Number Identified specimens (NISP), Weight (in grams), Minimum Number Individuals (MNI). Numbers in parentheses refer to charred bone.**

Pond/Map turtle						
Cooter						
Map turtle						
Unid. turtle	24(10)	4.3	-	12(3)	3.7	-
TOTAL TURTLE	25(10)	4.5	1	13(3)	5.6	1
Water snake						
Garter snake						
King/ratsnake						
Kingsnake				1	0.2	1
Ratsnake						
Racer/Coachwhip						
non-poison. snake (family)						
Viper (family)						
unid. snake						
TOTAL SNAKE				1	0.2	1
Bullfrog						
TOTAL AMPHIBIAN	-	-	-	-	-	-
Gar						
Gar scales						
Shad						
Minnow						
Carpsucker						
Hogsucker						
Redhorse						
	Feature 10			Feature 11		
Taxon	NISP	g	MNI	NISP	g	MNI
Unid sucker						
Brown bullhead						
Flathead cat.	2	0.5	1			
Unid. catfish						
Spiny-ray fish						
Bass						

Continued on next page

Table 8.2 Feature Data Number Identified specimens (NISP), Weight (in grams), Minimum Number Individuals (MNI). Numbers in parentheses refer to charred bone.

Smallmouth bass						
Sunfish (fam)						
Sauger						
Drum						
Unid. fish	3	0.4	-			
TOTAL FISH	5	0.9	1	-	-	-
TOTAL NISP	85(36)	55.3	6	82(22)	80.8	7
Unid'ble bone	17(6)	1.8	-	26(8)	3.3	-
TOTAL BONE	102(42)	57.1	6	108(30)	84.1	-

Feature 13

Taxon	NISP	g	MNI
Raccoon			
Skunk			
Cottontail			
Squirrel			
Fox squirrel			
Grey squirrel			
Pocket gopher			
Rat			
Beaver			
Muskrat			
Deer	15(4)	41.9	4
Deer antler	1	1.1	
Wapiti	1	14.6	1
very lg mam	2	8.1	-
lg mammal	66(42)	38.7	-
sm/med mam	6(3)	1.0	1
TOTAL MAMMAL	91(49)	105.4	6
Turkey	2	1.1	1
Lg bird	1	1.8	-
Med/sm bird	12(3)	1.6	1

Continued on next page

Table 8.2 Feature Data Number Identified specimens (NISP), Weight (in grams), Minimum Number Individuals (MNI). Numbers in parentheses refer to charred bone.

TOTAL BIRD	15(3)	4.5	2
Snapping turtle (fam)			
Mud/musk turtle (fam)			
Softshell turtle (fam)			
Box turtle	1	2.3	1
	Feature 13		
Taxon	NISP	g	MNI
Pond/Map turtle	2	7.3	1
Cooter			
Map turtle			
Unid. turtle	41(18)	10.8	-
TOTAL TURTLE	44(18)	20.4	2
Water snake			
Garter snake	1	0.1	1
King/ratsnake			
Kingsnake			
Ratsnake			
Racer/Coachwhip	1	0.2	1
non-poison. snake (fam)			
Viper (fam)			
unid. snake			
TOTAL SNAKE	2	0.3	2
Bullfrog			
TOTAL AMPHIBIAN	-	-	-
Gar			
Gar scales			
Shad			
Minnow	1	0.2	1
Carpsucker			
Hogsucker			

Continued on next page

Table 8.2 Feature Data Number Identified specimens (NISP), Weight (in grams), Minimum Number Individuals (MNI). Numbers in parentheses refer to charred bone.

Redhorse

	Feature 13		
Taxon	NISP	g	MNI
Unid sucker			
Brown bullhead			
Flathead cat.			
Unid. catfish			
Spiny-ray fish			
Bass			
Smallmouth bass			
Sunfish (fam)			
Sauger			
Drum			
Unid. fish	2	0.2	
TOTAL FISH	3	0.4	1
TOTAL NISP	155(70)	131.0	13
Unid'ble bone	51(19)	6.5	-
TOTAL BONE	206(89)	137.5	13

	Feature 14			Feature 15		
Taxon	NISP	g	MNI	NISP	g	MNI
Raccoon	2	1.0	1	3(1)	1.2	1
Skunk	1	0.4	1	1	0.2	1
Cottontail	1	0.2	1			
Squirrel	1(1)	0.2	-			
Fox squirrel	8	1.4	1			
Grey squirrel	1	0.1	1	3(2)	0.3	1
Pocket gopher*	2	0.3	1			
Rat				1	0.1	1
Beaver	2	0.6	1	2(1)	1.8	1
Muskrat				1	0.3	1
Deer	174(36)	409.4	5	78(11)	279.7	5

Table 8.2 Feature Data Number Identified specimens (NISP), Weight (in grams), Minimum Number Individuals (MNI). Numbers in parentheses refer to charred bone.

Deer antler	6(3)	3.6	-	2(2)	1.5	-
Wapiti	2	4.7	1			
very lg mam	20(3)	66.2	-	8(2)	23.6	-
lg mammal	1071(301)	461.4	-	477(166)	238.4	-
sm/med mam	81(22)	22.0	-	76(11)	14.5	-
TOTAL MAMMAL	1372(366)	971.5	13	652(196)	561.6	11
Turkey	14	21.5	2	2	7.9	1
Lg bird	20(3)	5.8	-	6	2.8	-
Med/sm bird	85(12)	19.5	1	38	8.0	1
TOTAL BIRD	119(15)	46.8	3	46	18.7	2
Snapping turtle (fam)	1	1.1	1			
Mud/musk turtle (fam)	26(5)	5.8	2	6	1.7	1
Softshell turtle (fam)	31(4)	6.9	2	9(5)	1.5	1
Box turtle	49(6)	36.5	3	29(5)	15.5	2
	Feature 14			Feature 15		
Taxon	NISP	g	MNI	NISP	g	MNI
Pond/Map turtle	26(7)	16.5	-	11(1)	8.6	-
Cooter	1	0.8	1	1	0.9	1
Map turtle	2	0.7	1			
Unid. turtle	712(109)	166.4	-	289(74)	68.8	-
TOTAL TURTLE	848(131)	234.7	10	345(85)	97.0	5
Water snake	1	0.2	1	1	0.2	1
Garter snake						
King/ratsnake	6(1)	1.2	1			
Kingsnake				1	0.1	1
Ratsnake						
Racer/Coachwhip	3(2)	0.5	1			
non-poison. snake (fam)	2	0.2	-	4(2)	0.5	-
Viper (fam)	3(2)	1.1	1	1	0.2	1
unid. snake	1	0.1				
TOTAL SNAKE	16(5)	3.3	4	7(2)	1.0	3
Bullfrog	2	0.6	1			
TOTAL AMPHIBIAN	2	0.6	1	-	-	-

Continued on next page

Table 8.2 Feature Data Number Identified specimens (NISP), Weight (in grams), Minimum Number Individuals (MNI). Numbers in parentheses refer to charred bone.

Gar	1	0.3	1	2	0.2	1
Gar scales	4	0.5	-			
Shad	1	0.1	1			
Minnow						
Carpsucker	1	0.1	1	1	0.1	1
Hogsucker	1	0.1	1	1	0.2	1
Redhorse	5	0.7	2	16	2.9	5

	Feature 14			Feature 15		
Taxon	NISP	g	MNI	NISP	g	MNI
Unid sucker	1	0.1	-	9	1.4	1
Brown bullhead				2	0.3	1
Flathead cat.	1	0.6	1	1	0.3	1
Unid. catfish	1	0.1	1	3(1)	0.5	-
Spiny-ray fish				4	0.5	-
Bass				1	0.1	-
Smallmouth bass	3	0.3	2	3	0.6	2
Sunfish (fam)	4	0.5	-			
Sauger	1	0.2	1			
Drum				1	0.5	1
Unid. fish	14(3)	1.7	-	33(2)	3.3	-
TOTAL FISH	38(3)	5.3	11	77(3)	10.9	14
TOTAL NISP	2395(520)	1262.2	42	1127(286)	689.2	35
Unid'ble bone	498(130)	73.5	-	217(49)	34.0	-
TOTAL BONE	2893(650)	1335.7	42	1344(335)	723.2	35

1. Number in parentheses indicates subset of charred fragments per taxon.

Table 8.3 Overall Composition of 1988 and 1990 vertebrate Samples from 3MR80D

	1988 Sample		1990 Sample	
	NISP%	Weight%	NISP%	Weight%
Large mammal	59.9	82.6	52.5	76.8
small/med mammal	2.9	1.1	5.3	2.2
bird	8.7	4.5	5.1	3.6
turtle	26.1	11.2	33.2	16.3
snake	0.5	0.2	0.7	0.2
amphibian	<0.1	*	>0.1	*
fish	1.9	0.5	3.2	0.8
Total NISP/ Total g	6470	4405.5g	3844	2221.5g

Given the foregoing zooarchaeological facts, some assessment of the degree to which these deposits have been affected by differential attritional processes can be evaluated. If the composition of pit deposits was largely a result of taphonomic factors rather than cultural factors, one might expect the material in these features to 1) be less extensively broken than bone in midden refuse as a consequence of less mechanical breakage (trampling) and 2) to contain more fragile elements than would survive in less protected environments both as a consequence of relatively less fragmentation but also due to less extensive predepositional chemical weathering. Only the former can be easily assessed since differential breakage can be measured with relatively crude data. Determining the relative representation of fragile elements is far too complex a task to assess here; fragile elements are found in all taxa -- the delicate nature of the bone being determined by morphology first, and density second.

Although in a relative sense it is easier, evaluating differential fragmentation is somewhat more complex than it might appear at first glance. If only average weight per fragment for the two samples is examined, the 1990 (all feature fill) sample, contrary to the above mentioned expectations, appears to be more fragmentary (NISP: average weight .68 g for 1988 sample; .58g for 1990 sample. Unidentifiable fragments: mean weight .15 g for 1988 sample; .11 g for 1990 sample). Since this relatively smaller fragment size could spuriously be a result of the relatively smaller body size of taxa known to be differentially represented in these pits, the degree of fragmentation of deer elements for the two samples was examined as a control. Again, feature fill showed greater fragmentation than mixed feature-midden deposits (79% v. 75% of deer elements were < 1/4 of their original size in feature only deposits), once more contrary to expectations based on trampling alone. Finally, the percent representation of large mammal "indeterminate fragments" was examined as a relative indicator of the degree of destruction experienced by each assemblage. These fragments exhibit trabeculae typical of deer-sized mammal elements (particularly the articular ends of long bones and vertebral centra), but are too small (highly fragmented) to allow element determination. For this comparison, all of the Late Woodland material from both excavations was considered, with all feature refuse (both 1988 and 1990 samples) combined. Again, relatively greater fragmentation is indicated in feature fill: 12.6% by weight of deer and large mammal remains in feature fill was indeterminate large mammal fragments versus 9.0% for all deer and large mammal bone in midden deposits (Table 8.4).

Based on all of the above quantitative assessments, feature fill apparently is even more highly fragmented than midden refuse despite the presumed relative protection afforded by intentional burial. Qualitative indicators of degree of physical attrition are less unidirectional, however. As mentioned previously, delicate fish bone is relatively more abundant in feature fill as might be expected in well protected environments. However, the same is not true of bird bone, also quite brittle, but in this sample, relatively more abundant (by both count and weight) in exposed midden deposits. Some evidence of differential trampling does show up in the bird bone in the midden. It occurs in smaller fragments in the midden (.35 g on average versus .41 g) and a larger percentage of the total bird bone is unidentifiable (94.8% unidentifiable fragments in midden versus 90.3% unidentifiable in pits, by weight); both indicate more extensive breakage in midden deposits (mechanical attrition). Although these figures suggest that trampling did affect naturally brittle bone in midden deposits, the differences between midden and feature deposits do not seem sufficiently different to argue that some portions of the midden deposit may be missing. Instead, I feel relatively confident that fish remains are largely absent in midden samples (both quarter inch and fine screen) because they were never, or rarely there.

Table 8.4 Relative weight of deer and large mammal anatomical units from different kinds of Late Woodland deposits at 3MR80D*

	Feature deposits (both 1988 & 1990 sample)			Midden deposits 1988 sample)		
	Deer	Lg.Mammal	Composite	Deer	Lg.Mammal	Composite
skull	23.6%	1.1%	11.5%	14.7%	1.4%	8.5%
axial	6.7%	5.3%	6.0%	9.6%	5.8%	7.8%
forelimb	25.0%	-	-	25.2%	-	-
hindlimb	18.9%	-	-	19.0%	-	-
long bone indet.	-	70.3%	58.1%	-	73.7%	58.1%
feet	25.8%	-	11.9%	31.5%	-	16.6%
indeterminate	-	23.3%	12.6%	-	19.1%	9.0%
Total g	1314g	1533g	2848.2g	1400.8g	1253.6g	2654.4g

*Approximate contribution of these anatomical categories in a complete deer skeleton are; 12% skull, 25% axial, 17% forelimb, 27% hindlimb, 19% feet.

By the process of elimination, it has been argued that the differences between midden and feature deposits appear to be more a function of seasonality than differential destruction due to variability in natural attritional processes. Almost without exception, bone in feature fill shows evidence of being more fragmented (and therefore not necessarily differentially protected) than bone in midden deposits. The differences in content between the two kinds of features must therefore be largely the result of cultural factors. As mentioned previously, there are many warm (particularly springtime) seasonal indicators in these large refuse-filled pits and a cultural reason for their use as refuse receptacles at the same time of year. Conversely, the midden deposits produce significantly more large mammal and slightly more bird bone than the features -- a function, perhaps, of their receipt of greater quantities of cold weather refuse. There are cultural reasons for the use of surface deposits during cold weather, as well: storage pits are full of stored foods and thus unavailable for use, the ground is frozen and excavation is difficult, large quantities of refuse (from the fall-winter deer and elk hunt) make underground disposal labor-intensive and impractical, and low ambient temperatures reduce noxious odors permitting the accumulation of surface refuse (the opposite is true for warm weather refuse). It should be noted here that the only deer frontal with fully ossified antler attached (a cool season indicator) thus far identified at the site came from the 1988 sample in a midden deposit (Scott 1990:184)

The Analysis: Subsistence and Seasonality

Although eleven previously unencountered taxa were identified in the samples from the five new features analyzed for this report, from an overall subsistence standpoint the composition of the sample was very similar to that previously reported. Most of the meat represented came from white-tail deer first, with wapiti (American elk) a distant second; all other taxa appear to have played only supplemental roles in the subsistence economy. Smaller taxa occurring relatively frequently in these deposits include wild turkey, beaver, squirrels, raccoon, softshell and box turtles. The "ubiquity" of these species is shown in Table 8.5, which combines both the first and second season vertebrate analyses. "Ubiquity" measures the degree of dispersal across a site, and is a good measure of the importance of small animals not likely to be shared beyond the family group (cf. Yellen 1977). Aquatic taxa do not appear to have played more than a very minor role in the subsistence economy, even though their relative ubiquity has been enhanced by the addition of the recently analyzed feature deposits.

Seasonality of these deposits has been discussed extensively in the taphonomy section. The site appears to have been occupied year-round, with warm weather refuse thrown into refuse pits and cool weather refuse accumulating in surface middens. This dichotomy is merely a trend observed inductively, and should not be considered absolute. There is plenty of wapiti and deer bone in refuse pits, just as there is an occasional fish in midden deposits. It should be noted, however, that almost without exception, the new taxa observed in this second sample are from cold-blooded species known to be more active in warm weather. They include map turtle, slider, garter snake, water snake, ratsnake, bullfrog, gizzard shad, carpsucker, brown bullhead, smallmouth bass, and sauger.

The addition of 26 fish individuals to the previous sample of 20 individuals (Scott 1990:185) provides a more reliable assemblage for inferring fishing strategies employed during the Late Woodland period (Table 8.6). The mean (and modal) size of fish procured is estimated to be 30-35 cm (standard length), a size well within what would be considered a reasonable game fish to modern anglers. Almost half (22 individuals) are filter feeders unlikely to take a hook, indicating that at least part of the fishing technology employed did not rely on this mode of capture. Without having analyzed fine screen samples from the site, it is difficult to determine if this fish profile is accurate; we may well be missing the smaller fish because of recovery bias. With the sample at hand, a reasonable interpretation accounting for the kinds and sizes of fish caught is that fish traps were used, with slats/vines placed far enough apart to allow smaller individuals to escape, and an aperture that excluded very large fish. However, many of the taxa present could also have been speared at the surface during spring spawning runs, or captured with weirs strategically placed along shallow streams; this technique also would have been particularly productive during the spring spawning run.

Deer and Wapiti Utilization

Together, deer and wapiti (American elk) contributed most of the meat in the diet of the Dirst site inhabitants. Judging from the kinds and frequencies of elements recovered in the Late Woodland sample, each deer and elk brought to the site was fully processed. The presence and relative frequency of bones producing relatively small quantities of meat or marrow (e.g. heads and feet), suggest that very little field dressing was practiced. Almost all marrow-yielding bones were fragmented, including most of the first and second phalanges, and the ventral border of the mandibles.

Although each deer was fully utilized, considerable selectivity in prey is suggested by the age structure represented in the composite sample. Most of the longbones recovered appear to be from adult deer (not necessarily with fused epiphyses, but largely grown, nonetheless). This general observation is corroborated by dentition. Without the addition of the three newborn/fetal deer from the Late Woodland features analyzed and reported here, all of which may have been procured unintentionally while bagging the mother, we now have dentition from a minimum of 19 individuals. At least six deer under the age of 2 years are present, nine and probably considerably more between the ages of 2 and 7 are present, and at least four deer older than 7 years were identified in the composite sample. The number of old deer (>7 years) is particularly noteworthy given the sample size, since their survival suggests that hunting pressure was not severe (cf. Elder 1965). I suspect that, -because so many of the middle-aged adult teeth recovered were isolated finds and hence difficult to confidently

Table 8.5 Ubiquity (Number of discrete occurrences) for taxa identified in 1988 & 1990 Dirst site samples.

	# occurrences	% of maximum (18)
Raccoon	7	39%
Skunk	3	17%
Mink	1	6%
Fox	1	6%
Dog	1	6%
Rabbit	1	6%
Cottontail	3	17%
Squirrel	1	6%
Gray squirrel	6	33%
Fox squirrel	4	22%
Chipmunk	1	6%
Woodchuck	2	11%
Pocket gopher	2	11%
Rat/Mouse	2	11%
Beaver	7	39%
Muskrat	2	11%
Deer	18	100%
Elk	14	78%
Turkey	11	61%
Musk turtle	8	44%
Snapping turtle	6	33%
Softshell turtle	10	55%
Aquatic turtle	9	50%
Box turtle	10	55%
Racer/Coachwhip	5	28%
Kingsnake	6	33%
Garter snake	1	6%
Water snake	2	11%
?Pinesnake	1	6%
Viper	4	22%
Frog	1	6%
Frog/Toad	2	11%
Gar	6	33%
Shad	1	6%
Minnow	2	11%
Carpsucker	2	11%
Hogsucker	5	28%
Redhorse	5	28%
Catfish	1	6%
Channel catfish	1	6%
Flathead catfish	4	22%
Bulhead	1	6%
Sunfish (family)	1	6%
Bass	5	28%
Sunfish	1	6%
?Rockbass	1	6%
Sanger	1	6%
Drum	2	11%

Table 8.6 Estimated sizes (Standard Length, in centimeters) of individual fish in Late Woodland period sample from Dirst site assemblage.*

Taxon	0-10	10-20	20-25	25-30	30-35	35-40	40-50	50-60	>60
Gar								2	2
Shad		1							
Minnow		2							
Sucker		1				1			
Carpsucker				1	1				
Redhorse			1	1	4	1	3	1	
Hogsucker				2	2				
Catfish (family)					1				
Channel catfish						1		1	
Flathead catfish					1	2	1		
Bullhead			1						
Sunfish (family)	1			1					
Sunfish			1						
Bass				1	3	1			
?Rock bass		1							
Sauger						1			
Drum				1					
Total	1	5	3	7	12	7	5	4	2

*Estimated lengths for gar are total length, and are based on Longnose Gar (Lepisosteus osseus) specimens. Includes data from both 1988 and 1990 excavations.

and precisely age, this age group is relatively underrepresented. The paucity of yearlings, however, corroborates the assertion that considerable selectivity was practiced.

In discussing butchering marks in the previous report on fauna from the Dirst site (Scott 1990:186), some comment was made about the number and depth of disarticulation marks on various elements. In particular, an astragalus, a distal humerus, and an ilium fragment all were noted as exhibiting exceptionally deep marks on the bone. The placement of the marks were for disarticulating the animal at the hock), the "elbow" and for removing the femur from the pelvis at the acetabulum (socket). The marks on the ilium fragment were assumed to have resulted from filleting meat in the original report, but based on more recent research on butchering patterns at the Crenshaw site, and additional literature review, I now believe these marks were for disarticulation (cf. Figure 4.22 in Binford 1981:113). Three additional bones exhibit similar marks in the latest sample analyzed: a wapiti lateral malleolus (Figure 8.1 a, relatively misdirected, but intended for disarticulation of the hind limb at the hock, a deer radial carpal (for disarticulation at the "wrist"), and distal femur (for disarticulation at the "knee", Figure 8.1 b) . As was true of the initial sample, nearly all of these marks were repeated two or more times, and most were quite deep, as if considerable force was required to sever the muscle and connective tissue.

In examining the second set of butchering marks, particularly the wapiti lateral malleolus,(which is deeply scored three times despite its small size), the only reasonable explanation for the violence and repetition of these gouges that I can envision is that they resulted from butchering stiff, frozen carcasses. The depth of these marks suggests that it was difficult to detect textural differences (hardness) between soft tissue and bone, which rules out rigor mortis alone. Despite occasional warm periods during an average Arkansas winter, frozen meat might well have kept without threat of spoilage in the shadow of mountains flanking the Buffalo River Valley.

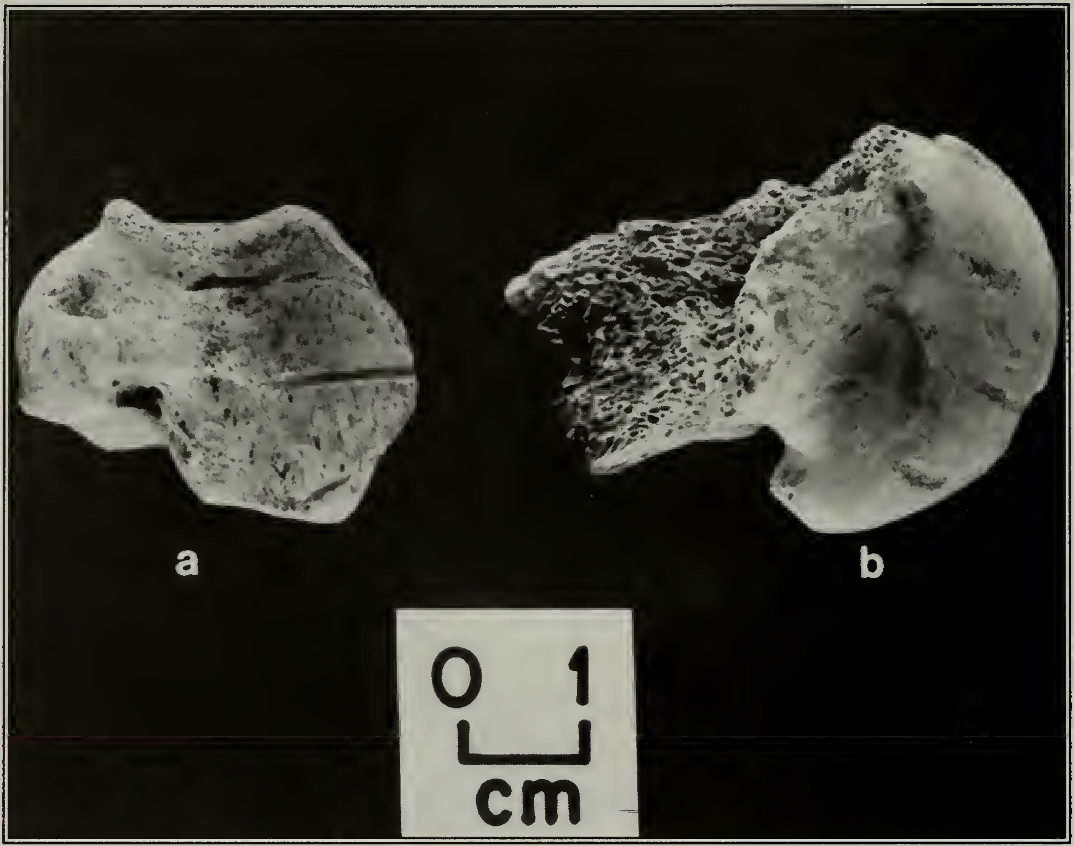

Figure 8.1 Butchering marks on lateral malleolus of a wapiti (a.) and distal femur of a deer (b.) AAS Neg. 916021

Elk elements identified in the second sample include a tooth fragment, a radius shaft fragment, a fused proximal femur, an unfused first phalanx, a dew claw, and the aforementioned lateral malleolus. In addition, as was true of the 1988 sample, a single carpal from an immature (<6 months) individual was found in the 1990 sample. With the exception of the unfused phalanx, all remaining bone appeared to be from adults. Although the size of the adult wapiti elements in the 1988 sample suggested they derived from females, the sex of the individuals present in this second sample could not be ascertained with the elements and comparative material available.

The timing of elk procurement is impossible to assess with present data. Because elk migrate to higher elevations in summer and overwinter in valleys (at least in the Rocky Mountains), theoretically they would have been a more concentrated resource during cool weather. The presence of several relatively young individuals (carpals and the unfused phalanx discussed above) rules out only spring hunting of the individuals represented, if fusion dates for other Cervids can be generalized to wapiti (Gilbert 1979), and says nothing about the timing of procurement for adults. The fact that wapiti bones occur consistently, but invariably in low frequencies probably indicates they were procured opportunistically on an encounter basis while hunting white-tail deer, and that once procured, because of the bulk involved, they were freely shared beyond the family group.

The relative frequency of deer elements for all of the Late Woodland deposits analyzed to date is shown in Table 8.7. Minimum number of elements was calculated without regard for symmetry, following Binford (1978) since such consideration may inflate the actual number of animals present. Also included in Table 8.7 is

Table 8.7 Minimum Number and Relative Frequency of Deer elements from 3MR80D Deposits.*

Late Woodland Deposits			
Element	MNI	%	Exp%
Maxilla	5.0	63	-17
Mandible	8.0	100	0
Atlas	3.0	38	-33
Axis	4.0	50	- 4
Cervical Vertebrae	2.0	25	- 6
Thoracic Vertebrae	1.2	15	-21
Lumbar Vertebrae	4.0	50	+ 1
Ribs	2.4	30	+ 5
Distal scapula	3.5	44	-10
Proximal humerus	2.0	25	+ 8
Distal humerus	4.5	56	- 2
Proximal radius	3.5	44	+ 3
Distal radius	1.0	13	-37
Ulna	2.5	31	na
Carpals	2.5	31	+ 6
Metacarpal	3.5	44	+ 8
Pelvis	5.0	63	-25
Proximal femur	5.5	69	+29
Distal femur	2.0	25	-10
Proximal tibia	3.0	38	+13
Distal tibia	3.0	38	-33
Tarsals	3.2	40	0
Astragalus	6.0	75	+39
Calcaneum	3.5	44	+ 8
Metatarsal	4.0	50	+ 9
Phalanx 1	3.5	44	+27
Phalanx 2	3.0	38	+25
Phalanx 3	1.8	23	+13

*Includes elements identifiable only as large mammal in addition to deer, and elements from 1988 and 1990 excavations.

the difference between the observed relative frequency of deer elements and the relative frequency of elements would expect to survive based on bone density (taken from Binford's "survival percentages" 1981:1921, Column 7).

Because the number of mandibles in the feature deposits analyzed for this report makes them the most frequently occurring element (as per predictions based on relative density of specific elements), the deer element frequencies in the composite sample are well in line with their expected survival percentages. The large negative numbers, particularly for long bones such as the distal radius, distal tibia, and the distal femur (relative to the proximal end) all suggest that vigorous cultural processing of these parts has both rendered them and rendered them unidentifiable. Both the radius and the femur would have provided good quality bone grease, and may have been processed beyond recognition in this pursuit. In addition, the practice of roasting meat attached to these elements, suggested by a few charred elements at the site (see below), may account for at least some of the missing elements, since charring renders the bone more brittle and susceptible to breakage.

The low representation of thoracic vertebrae in the Late Woodland sample also suggests differential destruction during butchering or consumption. It may be that thoracic vertebrae were destroyed through either of the means suggested above (intentionally for grease or accidentally through charring if the rib slab was customarily roasted), or during the process of butchering the animal. Many of the identifiable vertebrae, including at least one relatively complete thoracic vertebra, appeared to have been chopped with some cleaver-like tool during butchering (perhaps another forceful means of dividing a frozen carcass?), as is the case on the Plains (cf. Frison 1978). Because vertebrae are impossible to fillet (their irregular surfaces make meat removal very difficult), ethnographic studies have shown that, almost invariably, they are boiled. Some cultures even go so far

Table 8.8 Degree of Fragmentation of Deer and Large Mammal Skeletal Elements from Late Woodland Period deposits at 3MR80D*

Element	<1/4	1/4-1/2	1/2-3/4	3/4-Complete
Miscellaneous Skull	36			
Maxilla	8	2		
Mandible	23	2		
Atlas	1	1	1	
Axis		4		
Cervical Vertebrae	5	4	1	
Thoracic Vertebrae	12	2		
Lumbar Vertebrae	19	1		1
Ribs	141	1		
Scapula	10	4		
Humerus	11	6		
Radius	13	3		
Ulna	13			
Carpals	1	2	1	12
Metacarpal	17	2		
Pelvis	15	2		
Femur	24	1		
Tibia	22	2		
Tarsals	1	3	2	15
Astragalus	4	2	3	3
Calcaneum	9	5	1	1
Metatarsal	29	1		
Metapodial	38	1		
Phalanx 1	32	12	5	3
Phalanx 2	27	7	0	1
Phalanx 3	5	8	2	8
Phalanx 1/2	20	1	1	
Sesamoid	1			15

Total Fragments. (NISP)=692 (excluding isolated teeth and rarely encountered elements).

*Includes large mammal rib fragments, and elements from both 1988 and 1990 excavations.

as to refer to them as "womens' bones", because boiling is customarily carried out by females (roasting, on the other hand, is the preferred male cooking method). Since prolonged boiling (no doubt necessary to easily remove adhering meat) softens bone, this cooking method also could differentially destroy these elements.

Bone breakage at the site was consistently high for the Late Woodland assemblages (Table 8.8), with 78 of all identifiable elements reduced to less than one quarter of their original size. If all large mammal fragments were included in these calculations this number would be significantly higher since such fragments are so reduced that the element can no longer be identified. Even phalanges were consistently broken to obtain the relatively small amount of marrow in them. Such extensive breakage indicates full utilization of the animal -- meat, marrow, and bone grease -- and suggests that ignoring less desirable morsels was not an affordable luxury.

The relative frequency of charred fragments of specific deer elements is shown in Table 8.9. By and large, the frequency of burned fragments at the site is very low compared to some other sites in the Southeast. By way of comparison, a sample of Mississippian ceremonial center refuse from the Tombigbee Valley is also shown in Table I (derived from Scott 1983:299). Whereas 51% of identifiable elements were charred at this relatively large Mississippian site (the Summerville village), only 17% of elements at the Dirst site were burned. This pattern no doubt relates to differences in magnitude and population density at the two sites. Similarly, it was noted in the previous report that deer and other bone was more consistently burned during the later (Late

Table 8.9 Relative frequency of charred deer and large mammal elements from the Dirst Site and the Summerville Village.

Element	Dirst % charred	Summerville Village % charred
Maxilla	0	0
Mandible	0	8%
Atlas	0	40%
Axis	0	-
Cervical vertebrae	0	92%
Thoracic vertebrae	0	21%
Lumbar vertebrae	38%	53%
Ribs	13%	54%
Scapula	0	50%
Humerus	0	26%
Radius	8%	20%
Ulna	46%	nd
Carpals	31%	76%
Metacarpal	16%	31%
Pelvis	6%	21%
Femur	12%	28%
Tibia	8%	16%
Tarsals	19%	57%
Astragalus	42%	57%
Calcaneum	56%	50%
Metatarsal	30%	53%
Metapodial	23%	nd
Phalanx 1	15%	86%
Phalanx 2	27%	81%
Phalanx 3	4%	78%
Phalanx 1/2	45%	nd
Sesamoid	31%	nd

- Rib fragments include bones identifiable only as large mammal
- Sample sizes are
- nd = no data available

Woodland) occupation of the Dirst site, "perhaps because the resident population was larger, and putrefying garbage was more of a social affront" (Scott 1990:188). Excluding lumbar vertebrae, the elements most frequently burned in the Dirst assemblage are those of the feet: metapodials, carpals, tarsals, and phalanges. This pattern suggests an attempt to dispose of low quality parts in a relatively expeditious manner (these elements are also relatively frequently burned at the Summerville Village). In the 1988 sample, a few of the meatier longbones (femur, tibia) exhibited charring primarily in areas which would have been exposed during roasting over and open fire; no such patterning was noted in the material analyzed from features for this report -- none of these longbones showed any evidence of burning. Roasting meat over an open fire may have been carried out mainly in fall and winter.

Discussion

The picture which emerges from this analysis of faunal remains suggests that the prehistoric occupants of the Dirst site were well within the carrying capacity of their environment. Although the bulk of their meat supplies were provided by whitetail deer, considerable selectivity in choice of prey is evidenced by the age structure of the kill population. Other important faunal resources included elk, wild turkey, squirrels, raccoon, beaver, box and softshell turtles. None of these other species occurs in sufficient quantity to suggest an emphasis on second-line resources, such as might be expected under famine conditions.

From a more general anthropological standpoint, taphonomic analysis of the composition of midden versus feature deposits suggests that empty storage pits were recruited for refuse, and were filled in spring and summer, after their original function was unnecessary. In contrast, surface deposits (represented archaeologically as general level fill) appear to have received refuse primarily during the cold season, when noxious odors were less reprehensible, and frozen ground and full storage pits precluded underground disposal of unutilizable meat byproducts. This tendency for the content of the two kinds of deposits to reflect different aspects of the same subsistence system should serve as a cautionary note for future analysts to include representative samples of both kinds of deposits in their analysis.

CHAPTER 9

Artifact Analysis and Cultural Reconstructions for the Lower Midden Area

RANDALL L. GUENDLING

This chapter provides a technofunctional assessment of the prehistoric lithic and ceramic assemblages derived from the Lower Midden Area during the 1990 excavations. The lithic analysis follows the approach used by Sabo (Sabo et al. 1990) as adapted from Kay (1982a; 1984). A full discussion of the model and its application to the 3MR80 materials may be found in Sabo et al. 1990:195-200. Following the format used to organize artifact data from the 1988 excavations each component discussed below is identified first in terms of its age, artifact assemblage and associated features. Table 9.1 presents a summary of temporally diagnostic projectile points used to establish the relative ages of components (based on Sabo et al. 1990:139-144). Then, the cultural characteristics of each component are summarized in terms of activity profiles, technological processes, resource procurement, and external social relations (where possible). At the end of the chapter, a new cultural phase - the Rush Creek Phase - is defined for the Middle to Late Woodland component at the Dirst site.

Early to Middle Archaic Component, Stratum 2

The 1988 excavations indicated that Stratum 2 contained an Early to Middle Archaic component. The 1990 fieldwork reached Stratum 2 in two locations, the Dalton Area and in N996/E1028 in the Lower Midden Area. The analysis of the Stratum 2 materials from the Dalton Area (reported in Chapter 5) showed that the stratum contained diagnostics from a much longer time frame, representing the Early Archaic through Woodland periods, and that some degree of taphonomic disturbance had affected the stratum in this location. This same mixing has not affected Stratum 2 in the Lower Midden Area. Projectile point data summarized in Table 9.2 indicate that in this part of the site cultural materials associated with Stratum 2 are different from, and earlier than materials associated with overlying strata. One Big Sandy dart point was recovered in 1990 (Figure 9.1) from the Stratum 2 along with six other chipped lithic tools (Table 9.3). The assemblage is comparable to the one recovered from Stratum 2 during the 1988 excavations (Sabo et al. 1990:205).

The 1990 artifact assemblage is too small to draw many conclusions, though the distribution of raw materials is instructive (Tables 9.4-9.6). The chipped stone tools themselves are made exclusively of the local cherts Light Boone, St Joe, Reeds Spring, and Pitkin. Some raw material procurement outside the local area is indicated by the presence of Jefferson City cherts as well as small amounts of quartzite. This pattern is the same one identified for the Dalton component in Strata 1b and 2, and indicates that the general organization of lithic raw material procurement activities at 3MR80 remained unchanged into the Early-Middle Archaic period.

Early to Middle Archaic Period Component Summary.

The Stratum 2 component was assigned a date based upon the 1990 excavation of one Early to Middle Archaic Big Sandy point in stratigraphic context. Although other points temporally diagnostic of that period appeared to have come from Stratum 2 in the 1988 backhoe trenching, none were excavated in good context. Very few artifacts were found in this stratum in 1988 or 1990 and no features or organic enhancement of the soil are associated with the component. This may indicate that the site was not used intensively or that populations

Table 9.1 Projectile Point Chronology.

Type	Cultural Period
Dalton	Late Paleo-Early Archaic
Graham Cave	Early Archaic
Rice Lobed	Early/Middle Archaic
Big Sandy/White River Archaic	Early/Middle Archaic
Williams	Early/Middle Archaic
Castroville	Middle/Late Archaic
Afton	Late Archaic
Table Rock Stemmed	Late Archaic/Woodland
Smith Basal Notched	Late Archaic
Marshall	Late Archaic/Middle Woodland
Stone Square Stemmed	Late Archaic/Middle Woodland
Gary	Late Archaic/Woodland
Langtry	Woodland
Rice Side Notched	Middle/Late Woodland/Early Mississippi
Agee A Arrow	Late Woodland
Pocola	Late Woodland
Reed Side Notched	Late Woodland/Early Mississippi

Table 9.2 Typed Projectile Points, Premidden Strata.

Stratum 2	
Big Sandy	1
Stratum 3	
Afton	1
Marshall	1
Stratum 4	
Reed	1
Rice Side-Notched	1
Smith	1
Total	7

Table 9.3 Chipped Lithic Artifacts, Stratum 2.

Function	N	Percent
Projectile points		
Dart	1	14
Maintenance, manufacturing, and processing		
Biface	3	42
Core	1	14
Modified flakes	1	14
Stone tool production		
Tested pebble	1	14
Total	7	100

Table 9.4 Chipped Stone Artifacts by Raw Material, Stratum 2.

	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	TOTAL
Biface	2											1	3
Core	1												1
Tested pebble	1												1
Modified flakes						1							1
Dart					1								1
Total	4				1	1						1	7

Table 9.5. Flakes by Weight (g) and Raw Material, Stratum 2.

Size Grade	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	TOTAL
5.08	-	-	-	-	-	-	-	-	-	-	-	-	0
3.81	-	-	-	-	-	-	-	-	-	-	-	-	0
2.54	43.9	-	-	-	-	-	-	-	-	-	-	10.1	53.0
1.27	65.7	-	-	18.7	24.6	79.1	7.3	-	-	4.5	1.2	5.3	206.4
0.64	19.3	-	-	33.9	20.8	13.2	7.3	0.1	-	0.6	0.5	10.5	106.2
Total	128.9	-	-	52.6	45.4	92.3	14.6	0.1	-	5.1	1.7	25.9	365.6

Table 9.6 Shatter by Weight (g) and Raw Material, Stratum 2.

Size Grade	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	TOTAL
5.08	-	-	-	-	-	-	-	-	-	-	-	-	0
3.81	-	-	-	-	-	-	-	-	-	-	-	-	0
2.54	-	-	-	-	-	42.2	-	-	-	-	46.8	-	89.0
1.27	123.5	-	-	-	-	-	-	-	-	-	-	-	123.5
0.64	11.4	-	-	-	-	-	-	-	-	-	-	-	12.4
Total	134.9	0	0	0	0	42.2	0	0	0	0	46.8	-	224.9

were very small in keeping with our present understanding of Archaic hunters and gatherers. Nonlocal cherts found in this stratum also suggest that band territories or trading partners included southern Missouri.

At the time of the occupation, the Buffalo River channel flowed near the edge of the T 1 terrace and the modern floodplain did not exist. The river channel and flood cycles appear to have been stable.

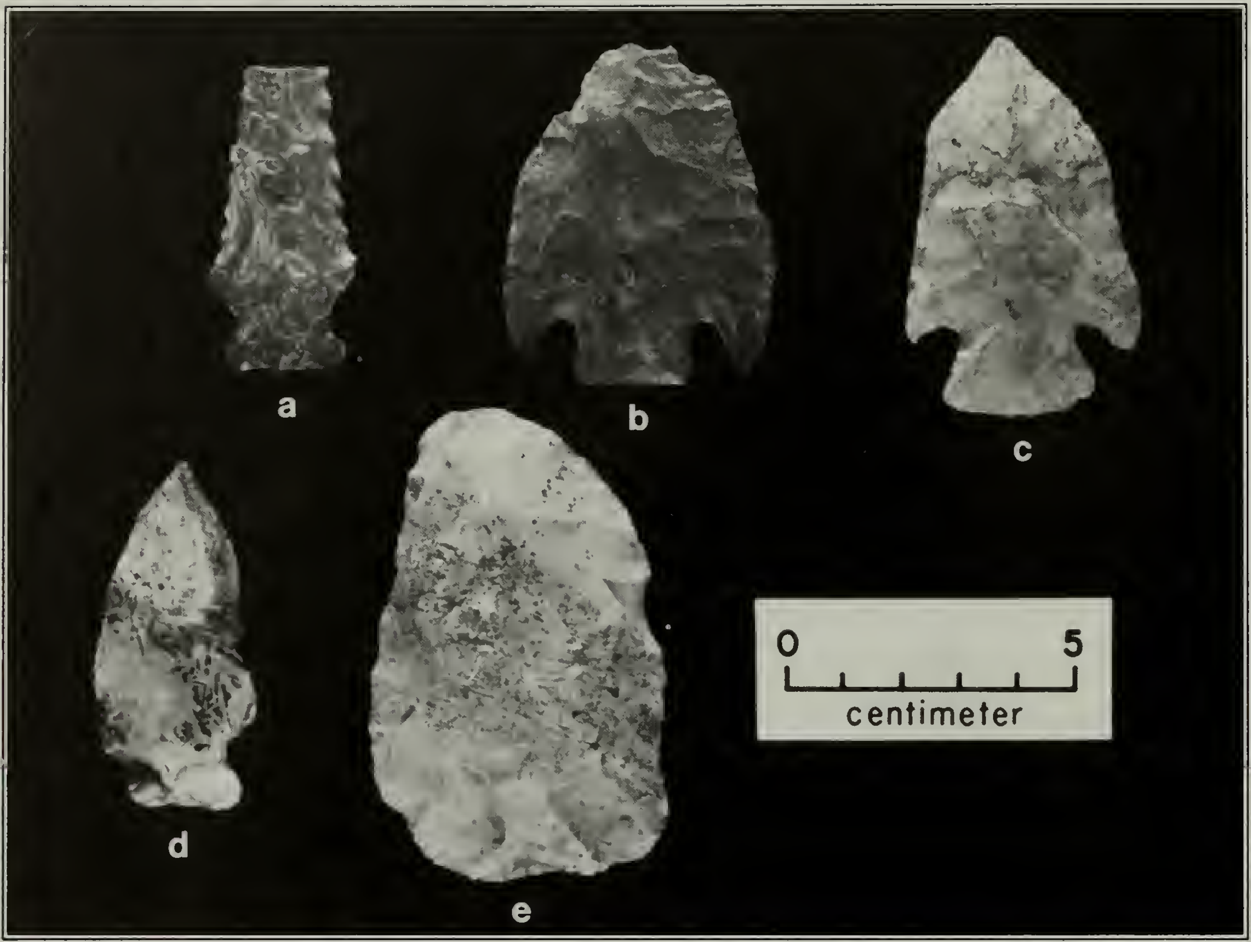

Figure 9.1 Artifacts from Strata 2 and 3. a.Big Sandy; b.Marshall; c.Afton; d.untyped; e.Biface (AAS Neg. # 915874).

Table 9.7 Chipped Lithic Artifacts, Stratum 3.

Function	N	Percent
Projectile points		
Dart	3	09
Maintenance, manufacturing, and processing		
Biface	6	19
Blade	1	04
Knife	1	04
Scraper	1	04
Hammer	1	04
Modified flakes	10	32
Stone tool production		
Tested cobble	2	06
Tested pebble	2	06
Unprepared core	4	12
Total	31	100

Table 9.8 Chipped Stone Artifacts by Raw Material, Stratum 3

	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	TOTAL
Retouched flake	1	1		3	2	2				1			10
Scraper		1											1
Tested pebble	1	1											2
Biface	2			1	1	1				1			6
Hammer	1												1
Tested cobble	2												2
Unprepared core	2					1						1	3
Dart						1		1				1	4
Knife				1									1
Blade					1								1
Total	9	3	0	5	4	5	0	1	0	2	0	2	31

Table 9.9 Table of Tools with Cortex, Stratum 3

	Cortex	No Cortex	Total
Biface	1	5	6
Hammer	1		1
Knife	1		1
Side scraper	1		1
Tested cobble	1	1	2
Tested pebble	2		2
Unprepared core	3	1	14
Total	9(29%)	10(32%)	17(31 total tools)

Late Archaic Component, Stratum 3

The 1990 excavations reached Stratum 3 in a single unit, N996/E1028. Analysis of materials representing a Late Archaic component in this stratum lend additional confirmation to Sabo's earlier characterization of this stratum.

Three Late Archaic period projectile points were recovered from the stratum in 1988 (Sabo et al. 1990:145) and the 1990 unit added two more diagnostic dart points to the collection (Table 9.2). Afton and Marshall types of points (Figure 9.1) are consistent with a Late Archaic period assignment of the component and all five projectile points cluster in a sealed context that Sabo has estimated was deposited at 5000-2000 BP. One small shell-tempered pottery rim sherd that was recovered in 1990 is definitely intrusive from above. The sherd was small enough to have been introduced to this stratum through root action, and all the excavations in the Lower Midden Area to date have demonstrated that shell-tempered ceramics are associated with Stratum 5.

Table 9.10 Modified Flakes by Weight (g) and Raw Material, Stratum 3

Size Grade	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	TOTAL
5.08	-	-	-	-	-	-	-	-	-	-	-	-	0
3.81	-	-	-	50.0	123.2	-	-	-	-	-	-	-	173.2
2.54	-	4.8	-	15.7	-	-	-	-	-	-	-	-	20.5
1.27	1.8	-	-	7.0	6.3	5.5	-	-	-	3.9	-	-	24.5
0.64	-	-	-	-	-	-	-	-	-	-	-	-	0
Total	1.8	4.8	0	72.2	129.5	5.5	0	0	0	3.9	0	0	218.2

The artifact assemblage from this component is presented in Tables 9.7-9.11. The inventory of 31 finished tools (Table 9.7) is similar to the 1988 assemblage. In both assemblages the majority of tool types fall into the maintenance, manufacturing and processing categories. The preponderance of cutting implements indicates a proportionate reliance on butchering animals and the single scraper likewise suggests associated hideworking. Tools associated with processing vegetal materials are not as heavily represented in either assemblage, although a grinding stone and a possible hammerstone were found.

The types of raw materials employed for tool making during the Late Archaic occupation favor the available local cherts. The Boone and St Joe formations account for 21 of the 31 lithic tools recovered (Table 9.8), though unlike the 1988 collections, nonlocal Jefferson City chert also occurs. A little less than one third of

Table 9.11 Flakes by Weight (g) and Raw Material, Stratum 3

Size Grade	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	TOTAL
5.08	-	-	-	-	-	-	-	-	-	-	-	-	0
3.81	130.5	-	-	50.0	123.2	-	-	-	-	-	-	-	303.7
2.54	192.5	41.3	-	15.7	13.6	-	26.5	-	-	-	-	23.2	312.8
1.27	270.9	21.1	18.1	123.7	79.5	219.0	-	2.4	-	7.0	-	152.7	894.4
0.64	97.0	17.5	13.3	47.7	43.3	70.4	-	10.0	-	2.2	0.8	73.4	375.3
Total	690.9	79.9	31.4	236.8	259.69	315.9	-	12.4	-	9.2	0.8	249.3	1886.2

the artifacts contained unremoved cortex (Table 9.9), which compares closely with results derived from the 1988 analysis. Surprisingly, no heat treating of the 1990 tools was observed though 47% of the 1988 tool collection was identified as heat treated. As stated before, the recognition of heat treating is a subjective exercise. I would again suspect that this inconsistency in the two rates of annealing is due to the differences in observers.

The 1990 flake assemblage broke down into raw material types that also corresponded to the distribution noted in 1988. The most favored cherts for expedient tools (modified flakes) came from the St Joe formation (Table 9.10) which appears to have a higher knapping quality compared to other types. The raw material type for all unmodified flakes (Table 9.11) mirror the raw material selection for finished tools. The Late Archaic peoples favored making tools out of mainly Light Boone and St Joe cherts.

Table 9.12 Shatter by Weight (g) and Raw Material, Stratum 3

Size Grade	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	TOTAL
5.08	-	-	-	-	-	-	-	-	-	-	-	-	0
3.81	-	-	-	-	-	-	-	-	-	-	-	107.4	107.4
2.54	86.1	-	-	-	-	-	-	-	-	-	-	174.5	260.6
1.27	235.7	2.3	11.2	-	-	-	-	-	-	-	-	35.2	284.4
0.64	36.1	2.8	-	0.2	2.1	1.6	-	0.5	-	-	-	16.5	59.8
Total	357.9	5.1	11.2	0.2	2.1	1.6	0	0.5	0	0	0	333.6	712.2

The distinctive Jefferson City chert is represented only in the smaller size grades (1.27 and .64 cm) which probably reflects the resharpening of completed artifacts (one of the bifaces was of Jefferson City chert). We would expect that distant, nonlocal cherts would be imported as preforms or finished tools and indeed no shatter (Table 9.12) or larger flake size grades of Jefferson City material were identified. The presence of both Pitkin chert and very small amounts of quartzite in the Stratum 3 assemblages derived in 1988 and 1990 indicates that these raw material types were being procured by the inhabitants of the site rather than secondary introductions presumably from overlying strata as Sabo speculated (1990:208).

There is a high relative number of cores and tested cobbles in both the 1988 and 1990 collections. However, the low amount of both larger flake size grades (2.54 cm and above) and shatter, except for the relatively inferior Light Boone chert (Table 9.12), conforms to the reconstructed chert reduction process outlined by Sabo (1990:217).

Late Archaic Period Component Summary

The Stratum three component was dated through recovery of a total of five projectile points temporally diagnostic of the Late Archaic period. As Sabo notes (1909:207-208), the Late Archaic occupation of the Lower Midden Area took place when the channel of the Buffalo River was nearer to the T-1 terrace than the present river during a period of stability in the hydrological regime and flood cycle. The bottomland vegetation communities were by this time period within range of the modern variations in the locality. This occupation is therefore conceived to be the first to be to adapting to the valley as we see it today. It is unfortunate that no features were preserved in Stratum 3 to provide a baseline with which to compare the later subsistence and settlement adaptations.

One interesting observation of the Late Archaic component is that the absolute size of the 1988 and 1990 collections were similar. Yet the volume of Stratum 3 excavated in 1988 was three times larger than the volume excavated in 1990. The area surrounding N996/E1028 might have been an area of higher activity, compared to other areas of the site.

The artifact assemblage from the stratum includes tool types indicative of hunting as well as gathering and processing of vegetal foods. The raw material types from the lithic assemblage includes nonlocal cherts available in southern Missouri and indicates that the resource procurement territories or trading networks remained the same as in the earlier periods.

The absence of features and midden development in Stratum 3 suggests a temporary or seasonal occupation by Late Archaic peoples. Assuming this conforms to previous reconstructions of Late Archaic societies as small scale mobile hunting and gathering groups (Sabo et al. 1988), easy access to resources proximate to the Rush locality (Sabo et al. 1990:25-60) was apparently of only limited importance in the economic rounds of these people.

Early Woodland Component, Stratum 4

The 1988 excavations defined Stratum 4 as an organically enriched sediment stratigraphically distinct from the over and underlying sediments (Guccione and Guendling 1990:99-106). The assignment of an Early Woodland cultural affiliation was based on several lines of evidence. Stratum 4 was underlain by a Late Archaic component and overlain by a living surface associated with Stratum 5 dated to the Middle to Late Woodland period both by radiocarbon assay and on typological grounds. Three diagnostic artifacts recovered from Stratum 4 in 1988 were Stone Square Stemmed, Afton and Langtry type points (Sabo et al. 1990:218-219), all dated in contexts consistent with the Late Archaic-Early Woodland boundary. But the presence of thick grog-tempered sherds, reminiscent of Early Woodland Williams Plain pottery, confirmed the Early Woodland affiliation.

One of the goals of the 1990 excavations was to trace the arc of postmolds defined in Stratum 4 during 1988. We had hoped that more complete delineation of this feature and excavation of more of the Stratum 4 midden would increase our understanding of the nature of the occupation associated with this component. Unfortunately, we discovered that the arc of postmolds was not fully preserved. Artifacts collected from this stratum during the 1990 excavations also indicate that the stratum has been partially disturbed by the activities of later occupations.

Three temporally diagnostic projectile points and 14 pottery sherds were recovered in 1990. A Reed Side Notched arrowpoint, a Rice Side Notched point and a Smith Basal Notched point were found (Figure 9.2) along with shell and grog-tempered pottery (Table 9.13). The Smith point and the grog-tempered sherds, especially a fabric impressed one (Figure 9.2), would comfortably fit in an Early Woodland assemblage. However, the Reed and Rice Side Notched points as well as the shell tempered sherds do not belong with the Early Woodland component. All work to date at 3MR80 indicates that shell-tempered pottery is associated with Stratum 5. The 1990 excavations (Chapter 6) demonstrated that some mixing of the deposits had occurred in the South Block. Disturbance associated with Stratum 5 features, including the house structure discussed in Chapter 6, could be expected to mix some artifacts into the underlying Stratum 4 sediments.

The assemblage of chipped lithic artifacts from Stratum 4 is presented in Table 9.14. The activities represented include hunting, butchering, hideworking, possible nut processing and other manufacturing or maintenance tasks. This profile is identical to the activities inferred from the 1988 collections (Sabo 1990:218-229).

Table 9.13 Ceramics, Stratum 4.

Temper	Sherd Catagory	N	Percent
Shell	Rim	2	15
	Body	7	50
	Base	-	--
Grog	Rim	-	--
	Body	5	35
	Base	-	--
Total		14	100

Unclassified sherds (less than 1.27 cm) = 7

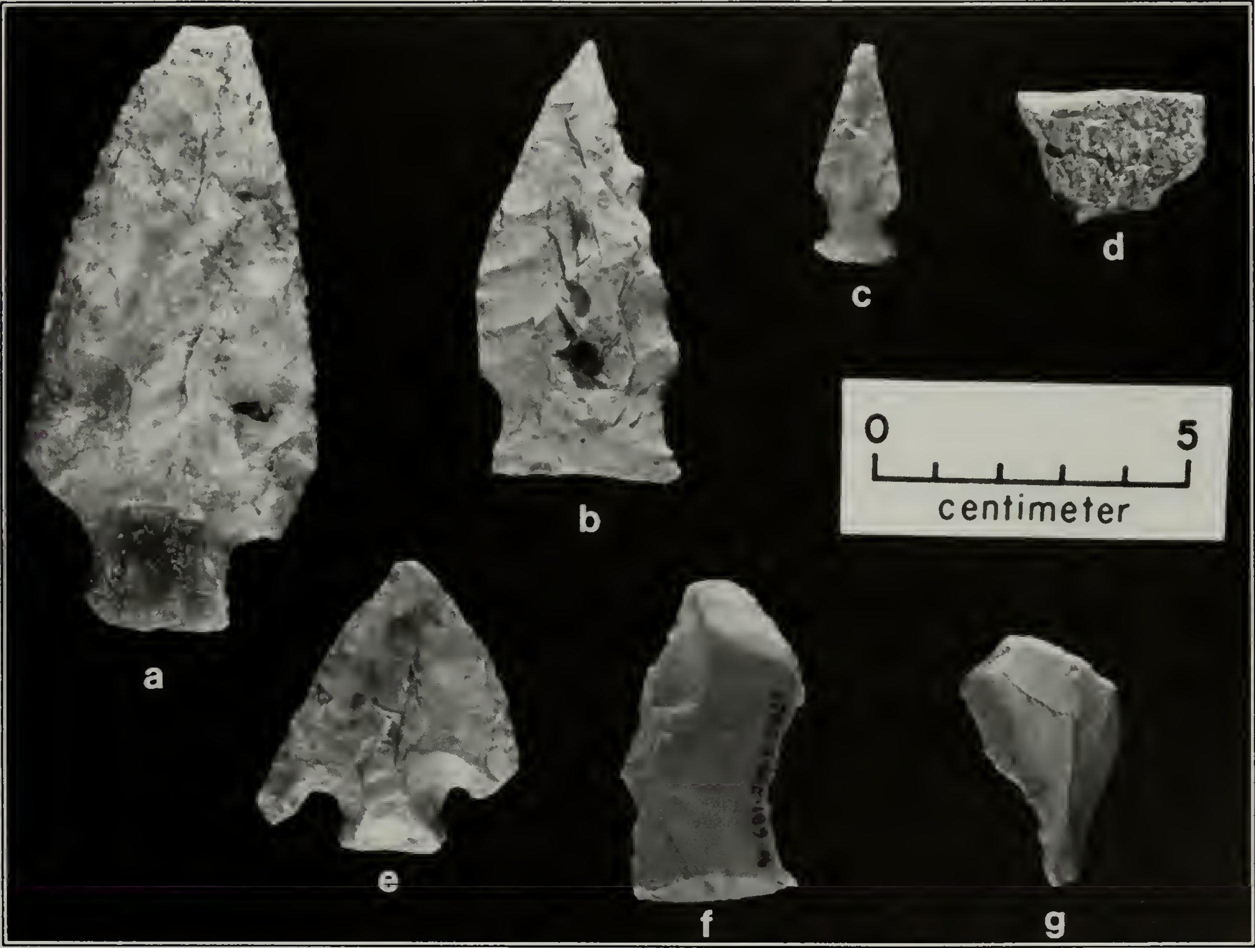

Figure 9.2 Artifacts from Stratum 4. a.untyped dart point; b.Rice Side Notched; c.Reed arrow point; d.grog-tempered fabric impressed sherd; e.Smith dart point; f., g.side/end scrapers (AAS Neg. #915978).

Table 9.14 Chipped Lithic Artifacts, Stratum 4.

Function	N	Percent
Projectile points		
Arrow	1	01
Dart	5	06
Maintenance, manufacturing, and processing		
Biface	18	20
Blade	4	05
Chopper	1	01
Knife	1	01
Modified flakes	45	51
Side/End scraper	3	03
Pitted stone	3	03
Stone tool production		
Core	1	01
Pebble core	1	01
Tested cobble	1	01
Unprepared	5	06
Total	89	100

The sherd assemblage from Stratum 4 is again small, as in 1988, when the shell-tempered sherds (presumably intrusive from Stratum 5) are removed from consideration. Though the stratum was incompletely sampled, with only one unit excavated through it, the relative low density of pottery appears to be a real observation as it was thought to be in 1988. This low representation of pottery would be expected in a population newly experimenting with a previously untried technology. The four plain grog-tempered sherds collected from the stratum, though, could be accommodated in the type Williams Plain as Sabo previously suggested, though it may be premature to assign type names on such little evidence. In addition, two small eroded fired clay pieces of twig impressed daub were recovered from the units south of the arc of postmolds. These few daub specimens most likely were accidentally created in a hearth or possibly came from clay smeared around a smokehole in the structure represented by the arc of postmolds.

The process of stone tool making did not appear to involve heat treating on as large a scale as Sabo recognized (1990:223), with only four modified flakes and a pitted stone from the 1990 collections exhibiting evidence of heat treatment. It is also apparent that finished tools are more likely to have all cortex removed (Table 9.15) during the manufacturing process than indicated in the earlier sample of artifacts. This apparent practice, though was not always followed, as several finished specimens retained some vestige of cortex.

The distribution of finished artifacts by raw material type (Table 9.16) confirms the pattern previously observed by Sabo that Boone cherts were preferred by a margin of four to three over the second most favored chert type, St Joe. The chert types located farther from the site are not heavily represented in the finished tool category, however it may be important to note that the use of Jefferson City chert is continued into the Early Woodland period. Similarly, quartzite waste continues to appear in the assemblage, though in small amounts. This would indicate that Early Woodland trading patterns or resource procurement territories changed little from the preceding Archaic periods.

The tabulations of modified flakes (Table 9.17) show a reversal of the chert preference pattern exhibited in the tool assemblage. In this category St Joe and Reeds Spring cherts are preferred, in that order, over the Boone cherts. The laboratory sorting of the modified flake chert types indicated that the St Joe type did retain a noticeably sharper edge than the Boone varieties of chert.

Table 9.15 Table of Tools with Cortex, Stratum 4.

	Cortex	No Cortex	Total
Biface	2	16	18
Chopper	1		1
Core	1		1
Dart	1	4	5
Pebble core	1		1
Tested cobble	1		1
Unprepared core	4	1	5
Total	11(12%)	21(24%)	32(89 tools total)

Table 9.16 Chipped Stone Artifacts by Raw Material, Stratum 4.

	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	SS	TOTAL
Unmodified flake	7	6	1	14	6	5				1		5		45
Arrow		1												1
Biface		8		2	2	4		1			1			18
Blade	1			2	1									4
Chopper				1										1
Core	1													1
Dart		2		1							1	1		5
Knife		1												1
Pebble core		1												1
Pitted stone													3	3
Tested cobble	1													1
Side/end scraper				2		1								3
Unprepared core	1			2		1		1						5
Total	11	19	1	24	9	11		1		1	2	7	3	89

A comparison of the 1990 unmodified flake and shatter categories (Table 9.18, 9.19) with the 1988 sample also displays the same pattern recognized by Sabo (1990:221-224). The highest amount of both flakes and shatter were the Boone varieties, reflecting the selection of this type for use in tool production, thus generating the greater waste. As Sabo observed, the higher ratio of flakes to shatter in Boone chert is also indicative of its inferior quality. One of the questions this prompts is why select Boone if it is inferior to the St Joe cherts and they both are equally available nearby? At this point we may only suggest that it is perhaps a reflection of the resource procurement strategy itself. The size grade data from 1988 (identical to the pattern shown in the tables in this chapter) suggested to Sabo that large cobbles were not being reduced on the site and that most bifaces were being fashioned directly from appropriately sized pebbles. This suggests that Boone cherts probably represent a higher percentage of available pebble cherts presumably selected from secondary sources lying in the creek beds.

Early Woodland Period Component Summary.

The component in Stratum 4 is dated by multiple lines of evidence. The stratum is underlain by a demonstrable Late Archaic component and overlain by a radiocarbon dated Middle to Late Woodland midden. Temporally diagnostic projectile points of the Late Archaic period are associated with thick grog-tempered sherds suggesting strongly an Early Woodland affiliation.

At the time of the occupation the Buffalo River channel was nearing its present position and the modern floodplain was aggrading. The environment was essentially the same as today.

Stratum 4 is organically enhanced, indicating a more intensive occupation than at any time before. An arc of postmolds on the south side of the site, when projected (Figure 9.3) forms a circular or oval structure representing a semipermanent or permanent occupation. A full range of hunting, maintenance, manufacturing, processing and woodworking activities are indicated by the artifact assemblage. No storage pits were found, though the organic enhancement of the stratum would suggest other activity areas on the site. The subsequent occupation of the site took place quickly enough that no sedimentation built between the time periods. As a result, subsequent living activity on the site has partially disturbed the Early Woodland component.

Although the 1990 excavations collected flotation samples from the Early Woodland levels, these were not analyzed for this report. However, the 1988 samples did indicate bone preservation was poorer than in the overlying stratum. The same samples also produced knotweed, bedstraw, chenopod and amaranth seeds, all pioneer plants that are known to develop symbiotically with humans in habitation areas. The the Early Woodland occupation of the Dirst Site in comparison to earlier occupations.

Table 9.17 Modified Flakes by Weight (g) and Raw Material, Stratum 4.

Size Grade	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	TOTAL
5.08	-	-	-	-	-	-	-	-	-	-	-	-	0
3.81	-	-	-	-	-	57.5	-	-	-	-	-	-	57.5
2.54	15.8	-	-	39.4	24.0	-	-	-	-	-	-	19.4	98.6
1.27	42.5	13.7	3.7	46.4	26.2	22.3	-	-	-	7.7	-	13.2	175.7
0.64	-	-	-	-	-	-	-	-	-	-	-	-	0
Total	58.3	13.7	3.7	85.8	50.2	79.8	0	0	0	7.7	0	32.6	331.8

Middle to Late Woodland Component, Stratum 5

Stratum 5, the thick, near surface midden deposit at 3MR80-Area D, has been the primary focus of two seasons of excavation. The first season of work on this component substantially altered our perception of the

Table 9.18 Flakes by Weight (g) and Raw Material, Stratum 4.

Size Grade	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	TOTAL
5.08	-	-	-	-	-	-	-	-	-	-	-	-	0
3.81	-	-	-	-	-	-	-	-	-	-	-	-	0
2.54	178.1	-	-	39.4	47.9	63.3	-	-	-	-	40.0	83.1	452.2
1.27	550.0	117.8	174.3	437.3	309.6	444.3	8.8	16.8	4.0	28.8	23.8	299.8	2418.5
0.64	277.7	135.5	76.6	309.6	230.3	156.4	0.5	35.3	8.6	13.4	9.5	326.8	1580.2
Total	1006.3	253.3	250.9	786.3	587.8	721.5	9.3	52.1	12.6	42.2	73.7	709.7	4505.7

Table 9.19 Shatter by Weight (g) and Raw Material, Stratum 4.

Size Grade	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	TOTAL
5.08	-	-	-	-	-	-	-	-	-	-	-	-	0
3.81	-	-	-	-	-	-	-	-	-	-	-	-	0
2.54	-	-	-	-	31.2	-	-	-	-	-	-	38.4	69.6
1.27	286.4	37.5	-	18.9	2.2	39.4	-	6.5	-	-	51.4	34.5	476.7
0.64	56.9	29.9	2.5	9.6	8.5	3.1	-	0.1	-	0.5	2.3	30.7	144.1
Total	343.3	67.4	2.5	28.5	41.9	42.5	0	6.5	0	0.5	53.7	103.6	690.3

archeology of the Woodland period in the Ozarks. The results of the 1988 season had established the component as a compacted rock strewn living surface at the base of a rich midden deposit containing features, bone, shell, charcoal, carbonized floral remains, both shell and grog-tempered pottery and a large lithic assemblage. The temporally diagnostic lithic artifacts in the midden were characteristic of Middle to Late Woodland assemblages in the Ozarks and adjacent regions. However, the shell-tempered pottery, usually considered indicative of Mississippian cultures, was found in a pit feature along with other Middle to Late Woodland artifacts. Radiocarbon dating of this pit feature established its Middle to Late Woodland period age. The same pit also contained small amounts of maize and other native cultigens. A second feature, higher in the midden, dated to the early Mississippi period. These dated features suggested that the midden built up between the Middle Woodland

and early Mississippi periods. Most surprising was the association of maize and shell-tempered pottery in a pre A.D. 800 context.

The 1990 excavations produced confirmation of the early association of maize and shell-tempered pottery in three additional features, all within the midden, radiocarbon dated to the Middle to Late Woodland period. A few artifacts from an as yet unidentified Mississippi period component were also found. A part of a rectangular house probably also dating to the Woodland time period, was uncovered. Shell-tempered pottery was also found to be much more common in the Woodland component represented by the midden than previously suspected. All of this evidence suggests the midden built up very quickly and was associated with the introduction of both shell-tempering technology and the use of maize.

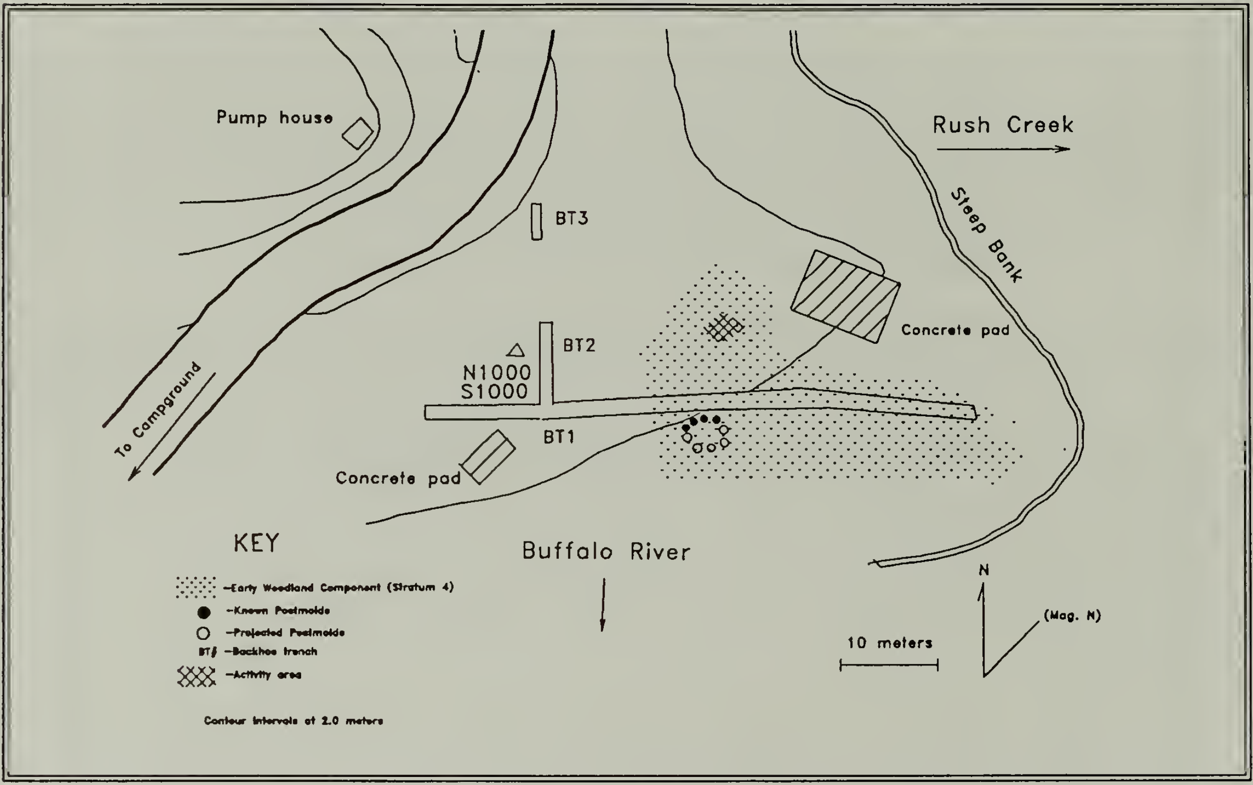

Figure 9.3 Early Woodland Component, 3MR80-Area D.

A large assemblage of artifacts was again recovered from the midden and, given the much tighter dating of the stratum, constitutes a single analytical unit. The diagnostic projectile points from the stratum present a wide array of types (Table 9.20), but the dominant types, as in 1988, are Scallorn arrowpoints and Rice Side Notched dart points (Figure 9.4, Figure 9.5). Together these two types constitute 74% of the named types from 1990. The second most numerous dart type is Langtry followed by Gary ,*var. Gary* and Gary, *var. LeFlore* (Figure 9.6) consistent with a Middle to Late Woodland component in the Ozarks. Agee arrowpoints constitute a smaller inclusion in the midden, though all the named points are consistent with a Middle to Late Woodland age. The Agee A and Fresno points are probably of a Late Woodland context but (Figure 9.7) may also represent a minor Mississippi period component. As expected, some eight darts from earlier periods were identified in the midden assemblage (Table 9.20, Figure 9.8), either found and curated by the inhabitants or turned up during their digging of storage pits through earlier occupations.

Table 9.20 Typed Projectile Points, Stratum 5.

Arrowpoints		
Agee A	4	04
Fresno	1	01
Scallorn	42	44
Dartpoints		
Gary	4	04
Graham Cave	1	01
Langtry	10	10
Marshall	2	02
Rice Side Notched	27	28
Stone Square Stemmed	1	01
White River Archaic	1	01
Williams	1	01
Castroville	1	01
Table Rock Stemmed	1	01
Totals	96	100

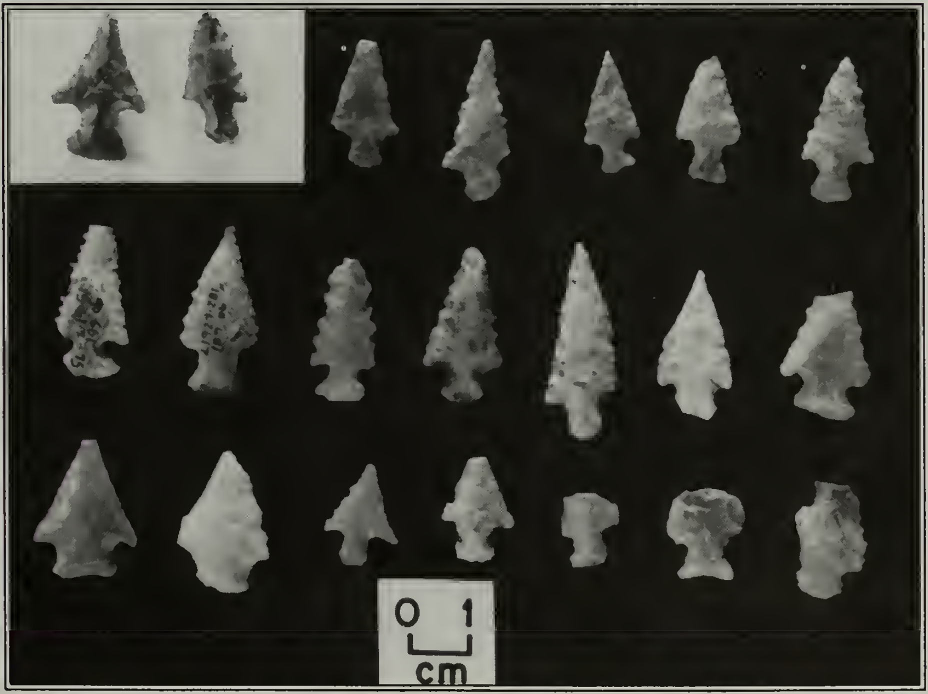

Figure 9.4 Scallorn arrowpoints Stratum 5 (AAS Neg. # 916024).

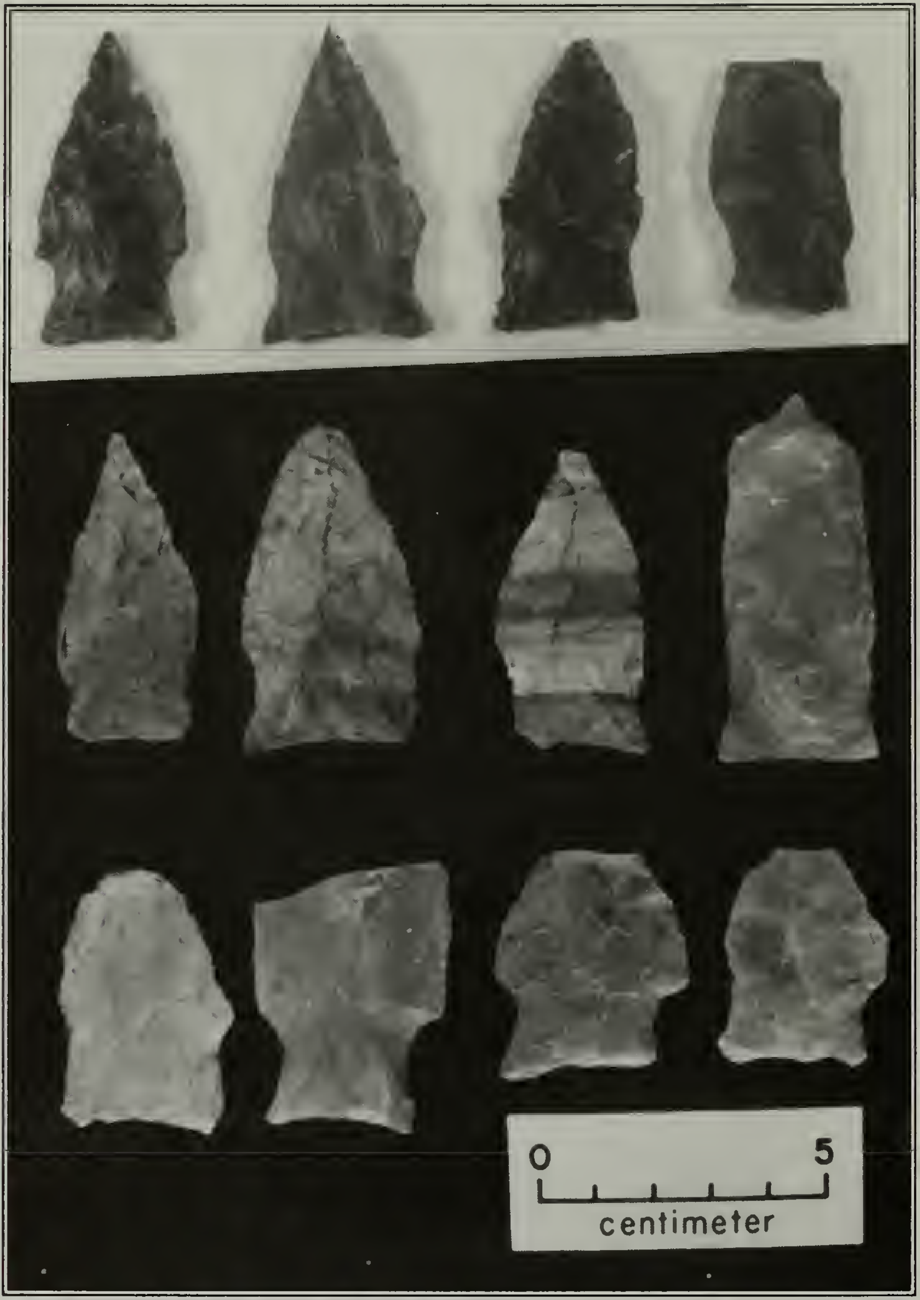

Figure 9.5 Rice Side Notched dart points, Stratum 5 (AAS Neg. # 916038).

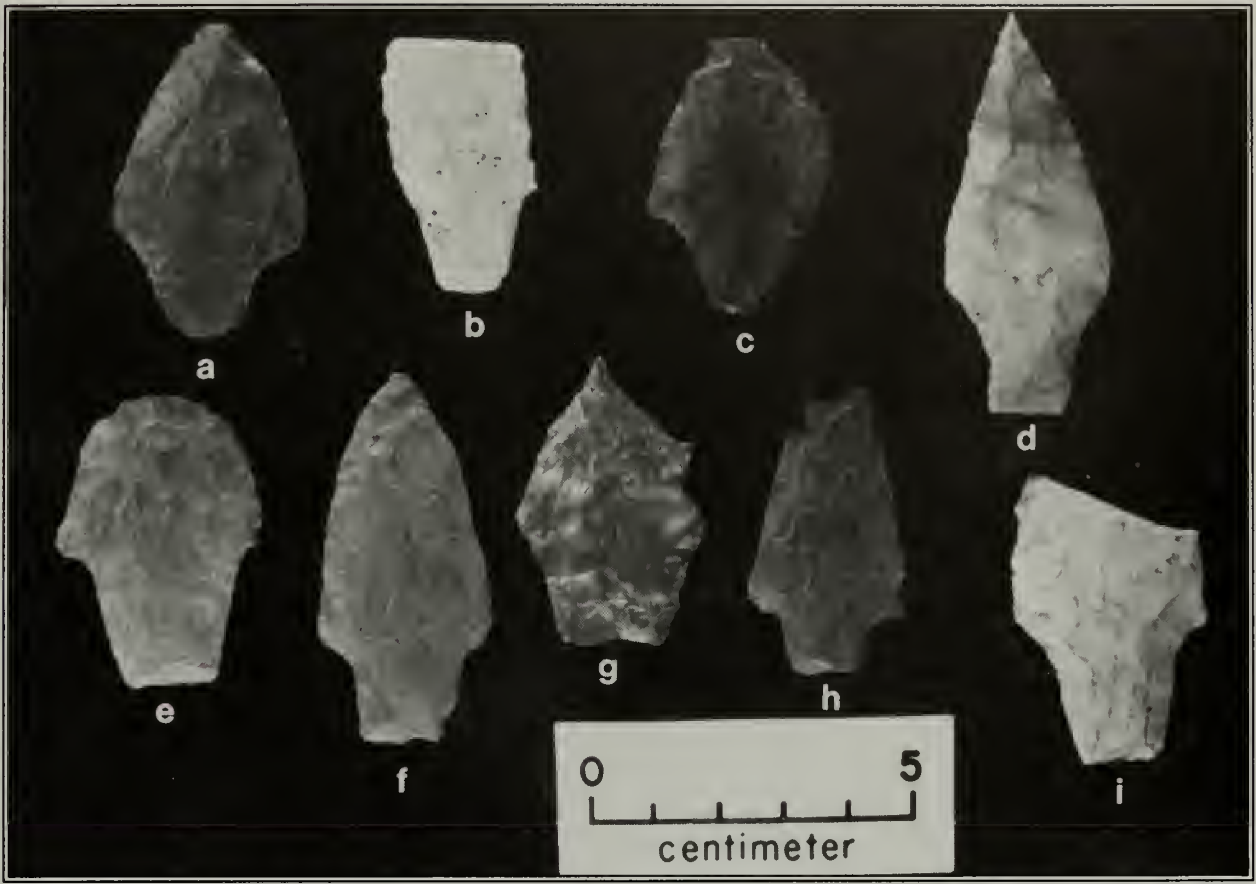

Figure 9.6 Woodland dart points. a.,b.Gary, G*ary*; c.Gary, *LeFlore*; d.-i.Langtry (AAS Neg. # 916027).

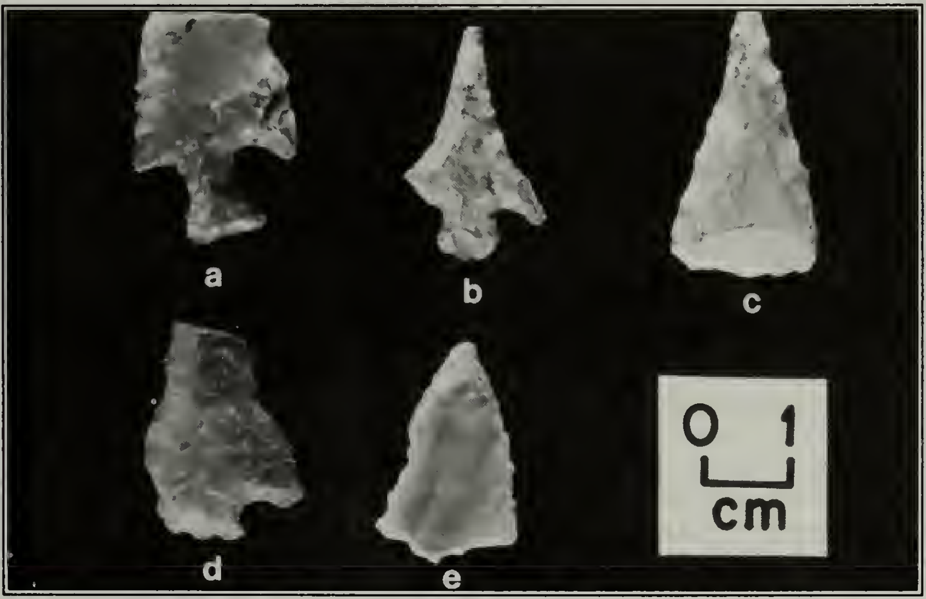

Figure 9.7 Late Woodland/Mississippi Period arrowpoints, Stratum 5. a.,b.Agee A; c.Fresno; d,.e.arrow preforms (AAs Neg. # 915981).

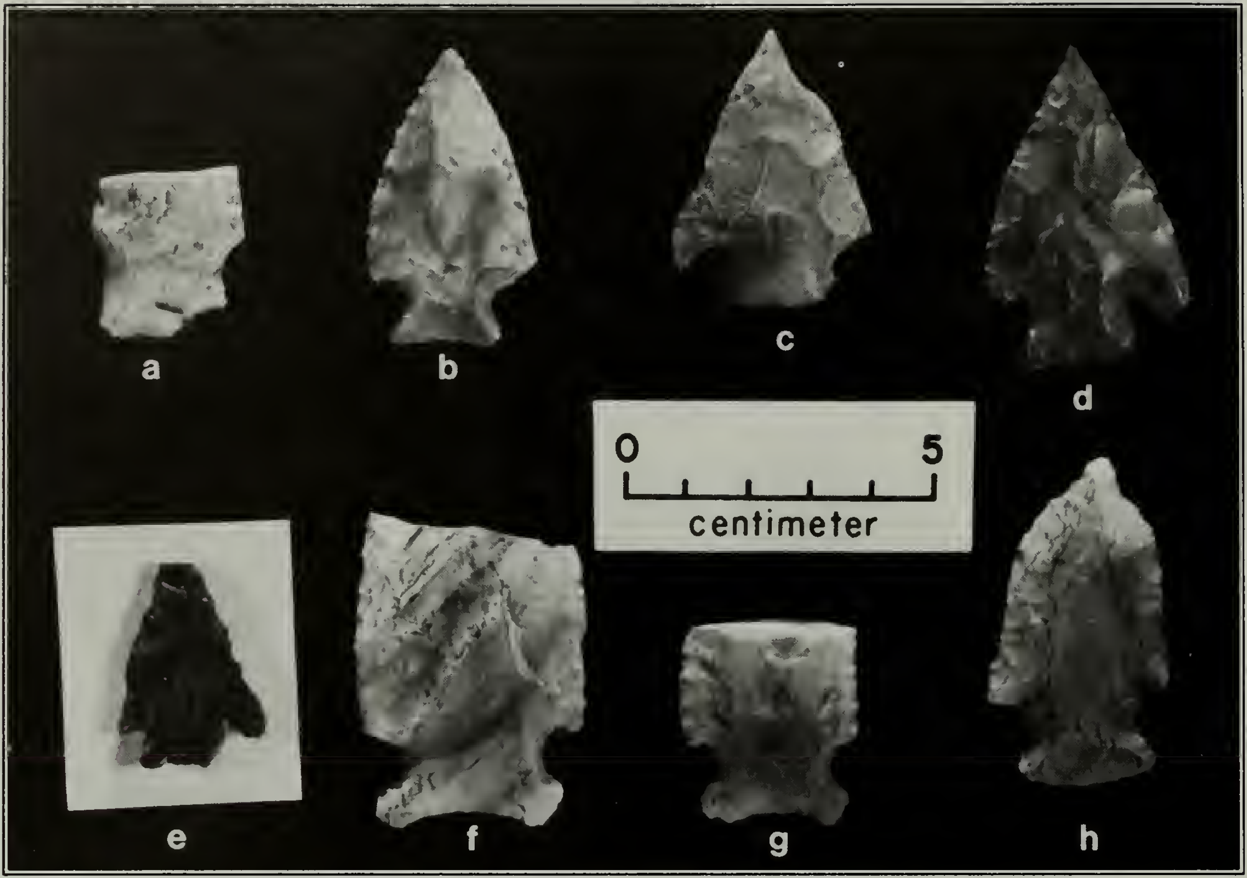

Figure 9.8 **Curated dart points, Stratum 5. a.Stone Square Stemmed; b.Table Rock Stemmed c.Castroville; d.,e.Marshall; f.White River Archaic; g.Graham Cave; h.Williams (AAS Neg. # 915971).**

The large assemblage of chipped and ground stone artifacts (Table 9.21, 9.22) reflects a very broad range of activities. As in the 1988 collections, bifacial cutting implements were one of the most numerous of the tool categories and many were fragmentary, attesting to their heavy usage. One category of tool, choppers, are heavy cleaver like bifaces (Figure 9.9) that would be especially useful in dismembering large prey animals such as represented by the cut elk bone pictured in Chapter 8. Numerous scrapers, drills, awls, and gravers (Figure 9.10) suggest extensive hideworking and shell or bone working on the site. Examples of bone and shell carving were recovered from the features in the midden (Figure 9.11). Also represented in the collection were several adzes and a celt preform (Figure 9.9) which could have been used for manufacturing hollowed out wooden items from bowls to dugout canoes, as well as preparing structural members for houses. Many of the manufacturing and maintenance activities suggested by the full midden assemblage are also found in the features (Figure 9.12-9.14). Susan Scott has suggested that the content of the features themselves may have been scraped from living surfaces and used to fill empty storage pits. The chipped lithic assemblage from the features would therefore not necessarily contain all of the tool types found in the midden. In fact, artifacts from the feature contents appear to represent a random selection of the larger midden assemblage. We would also expect to find some aberrant projectile point types from earlier periods and in fact we did find a Castroville point in the Feature 14 fill (Figure 9.14).

Table 9.21 Chipped Lithic Artifacts, Stratum 5.

Function	N	Percent
Projectile points		
Arrow	82	04
Dart	87	05
Maintenance, manufacturing, and processing		
Awl	3	*
Biface	349	20
Blade	17	01
Chopper	13	*
Cobble tool	5	*
Denticulate scraper	3	*
Drill/Awl	3	*
Drill	2	*
Drill/Perforator	3	*
End scraper	2	*
Graver	1	*
Hammer	1	*
Knife	48	02
Pebble tool	4	*
Perforator/graver	1	*
Scraper	1	*
Modified flakes	822	48
Side scraper	1	*
Side/end scraper	1	*
Spokeshave	2	*
Unprepared core	71	04
Stone tool production		
Arrow preform	18	01
Celt preform	1	*
Dart preform	1	*
Pebble core	21	01
Shaped core	13	*
Core	79	*
Tested cobble	9	*
Tested pebble	16	*
Woodworking		
Adze	1	*
Adze-like	4	*
Total	1685	100(86%)

* = less than .01

Table 9.22 Ground Lithics Artifacts, Stratum 5.

	BBOONE	CRT	GBOONE	LBOONE	STJOEG	SS	TOTAL
Hammer	1	5		4		1	11
Abrader		1					1
Mano		2	1				3
Pestle		1					1
Pitted stone		1				6	7
Total	1	10	1	4		7	23

The 1990 stone tool working assemblage is identical to the one defined and discussed by Sabo (1990:232). It is dominated by four distinct types of cores: tabular cores, shaped cores, pebble cores and unprepared cores. All of the pebble cores and many of the other cores retained cortex (Table 9.23) and appear to be creek cobbles. When all the obvious stream pebbles and cobbles are subtracted the overall number of tools retaining cortex is reduced significantly.

The assemblage of ground stone tools (Table 9.22) is especially interesting, both because they represent tool making and food processing activity and because of their raw material type. Only seven of the ground stone items are sandstone, 16 are chert selected from stream cobbles.

Table 9.23 Table of Tools with Cortex, Stratum 5.

	Cortex
Adze-like	3
Arrow	3
Arrow preform	2
Biface	39
Chopper	10
Cobble tool	2
Core	11
Dart	2
Drill/awl	1
Hammer	8
Knife	3
Pebble core	18
Pebble tool	2
Pestle	1
Modified flakes	10
Shaper	10
Spokeshave	2
Tabular core	15
Tested cobble	5
Tested pebble	7
Unprepared core	42
Total	268

The raw material distribution for the finished tools (Table 9.25) represents a slightly different pattern from that identified in 1988. The Woodland period inhabitants of the site were selecting for St Joe cherts in their tools (total 601) over the Boone cherts (Total 556) and well over all other chert types. The St Joe cherts were also favored as expedient tools (Table 9.26). A few quartzite artifacts were found in 1990; these were present in the 1988 collections, also in small numbers. The other more distant lithic sources, Cotter and Jefferson City cherts, do not seem to have been used for tools making.

The 1990 debitage assemblage is consistent with the pattern identified from the 1988 collection. The flake and shatter categories (Table 9.27, 9.28) indicate that the Boone cherts produced significantly higher proportions of waste than the other material types. Sabo thought that this might indicate a shift away from heat treating the Boone types prior to knapping, a departure from the Early Woodland pattern. The size grade data for both categories supports this suggestion. The presence of chert debitage in the size grades above 2.54 cm indicate that larger chunks of chert were being brought to the site for reduction, and quarrying rather than utilization of only small expediently gathered cobbles seems to be indicated. In the 1988 assemblage the larger size grades were in the Boone, St Joe and Reeds Spring types. The same pattern is seen in the 1990 data. However, a larger

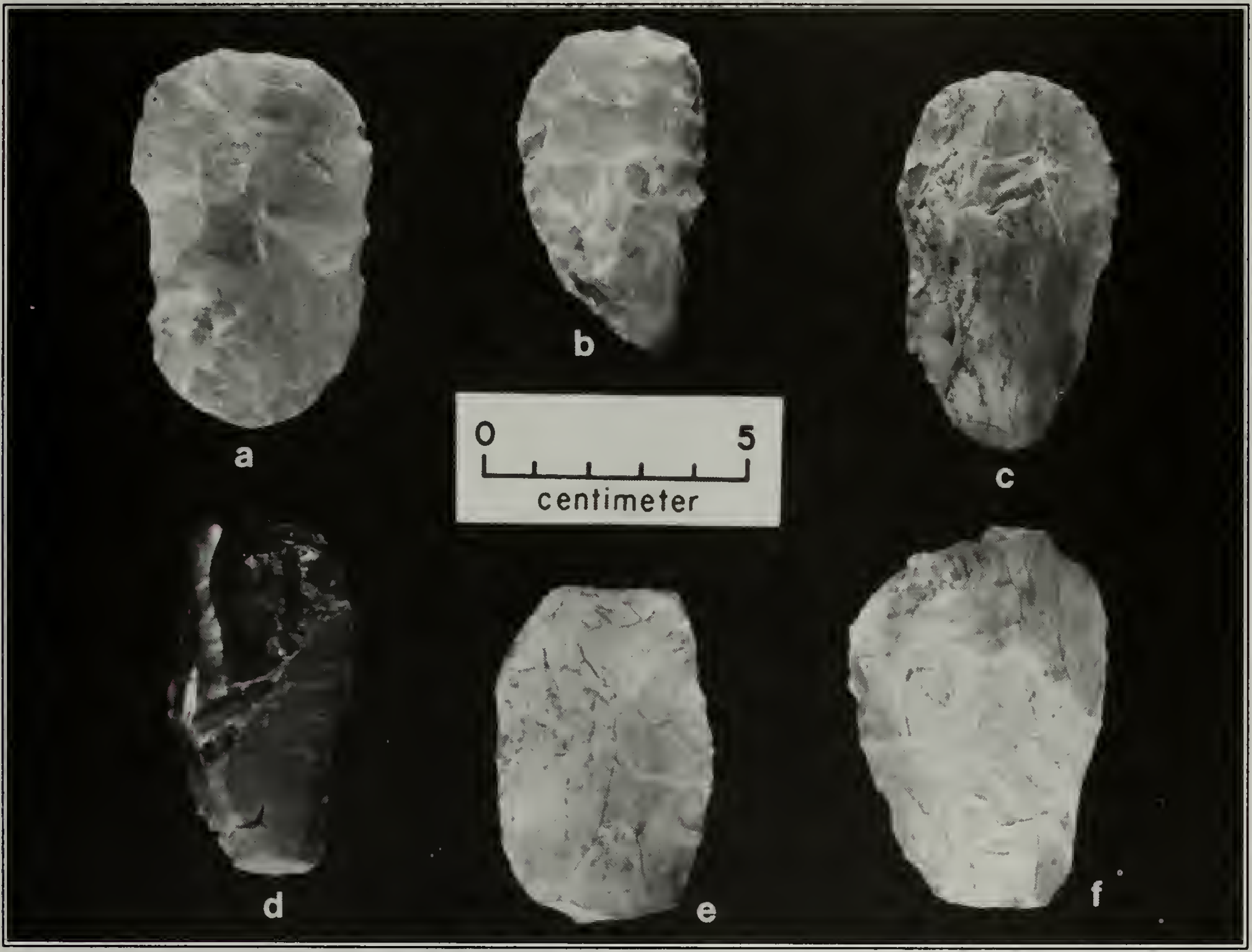

Figure 9.9 Woodworking Tools, Stratum 5. a.Adze; b.celt preform; c.Celt; d.adze-like biface; e.draw shave; f.chopper (AAS Neg. #916007).

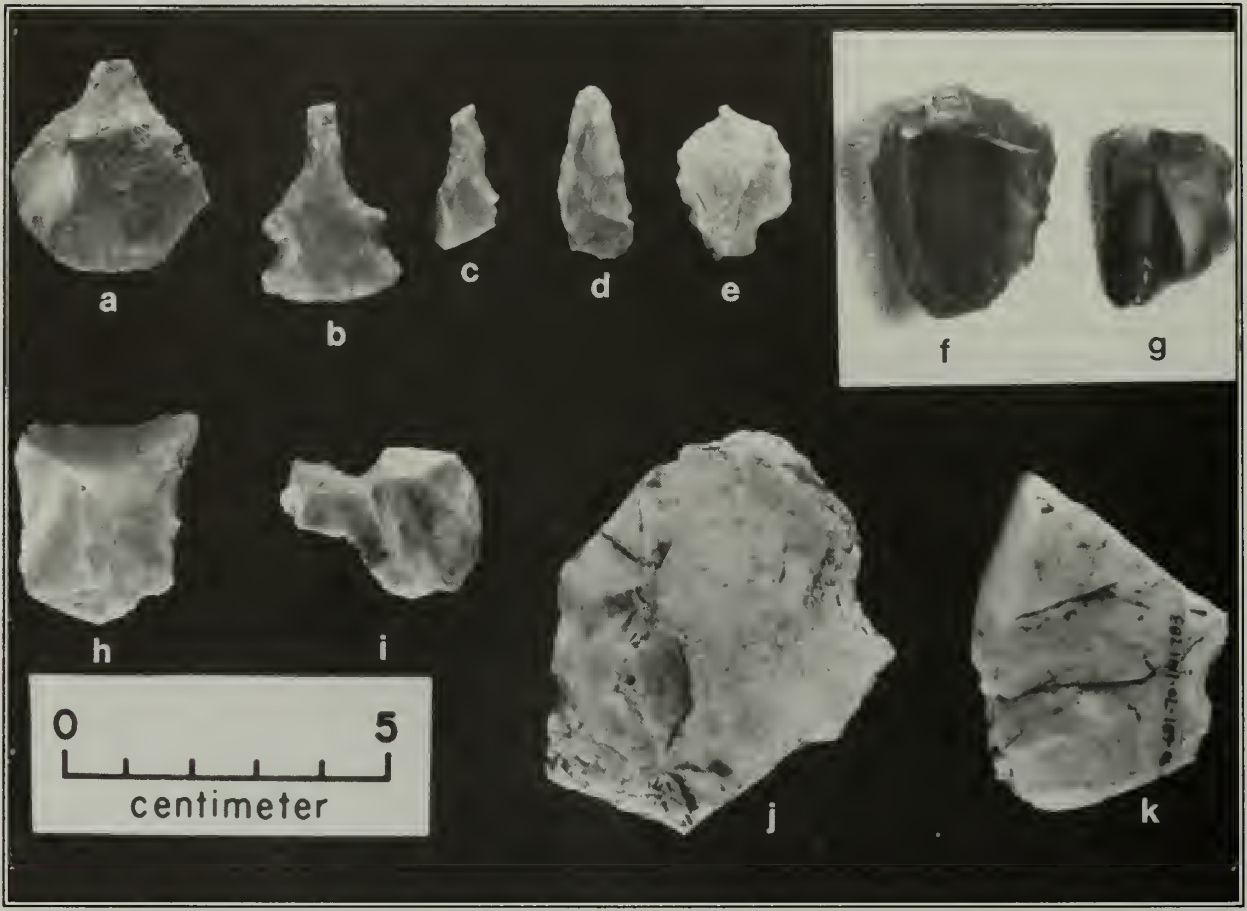

Figure 9.10 Flake Tools, Stratum 5. a.drill/awl, O head; b.drill/awl, reworked dart point; c.,d.drill; e.graver; f.,g.end scrapers; h.side scraper; i.denticulate scraper; j.,k.spokeshaves (AAS Neg. # 916014).

amount of quartzite shatter and flakes are also present in the 1990 sample in the larger size grades. This implies some on-site working of this material, though finished artifact fragments are rare. It may therefore be the case that quartzite was a special category of material, perhaps used to make finished artifacts for trade or other special use.

The analysis of the 1990 ceramic assemblage produced some of the most important new data added to our knowledge of technological innovation in the Ozarks. The 1988 excavations recovered 198 identifiable ceramic sherds (i.e. those over 1.27 cm). The 1990 excavations increased this sample by 616 identifiable sherds (Table 9.29). A total of 448, or 72 % of the assemblage were shell-tempered or had shell added to other tempering agents (Figure 9.15, 9.16). The shell-tempered pottery in the midden is not part of an unrecognized intrusive Mississippian component, since the pottery is distributed throughout the midden and is present in all Stratum 5 features (Table 9.30, Figure 9.17) along with other Middle to Late Woodland artifacts.

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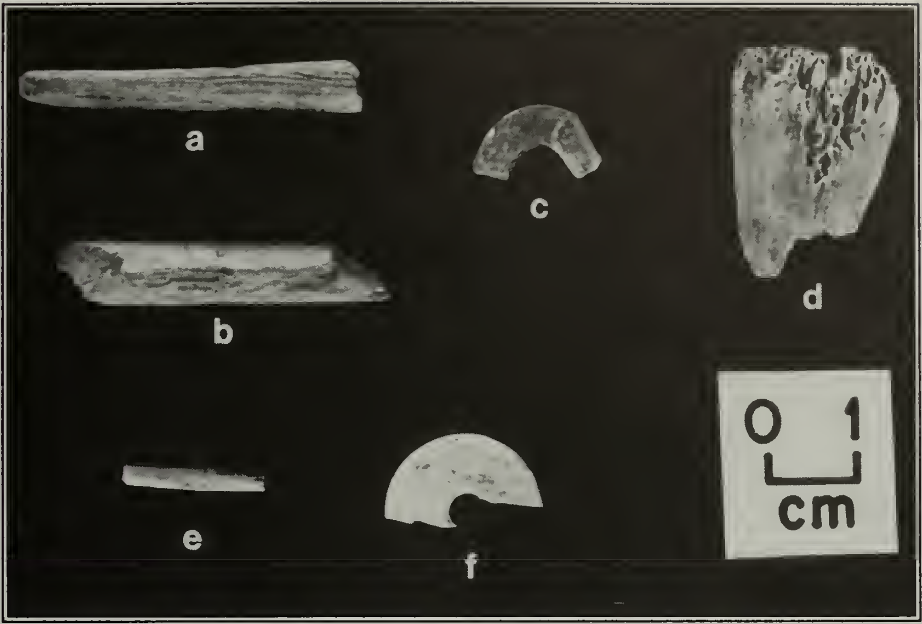

Figure 9.11 Modified bone and shell items from features. Feature 13, a.cut bone; Feature 14, b.cut bone, c.bone bead, d.modified deer element; Feature 15, e.bone needle, f.shell bead (AAS Neg. #915989).

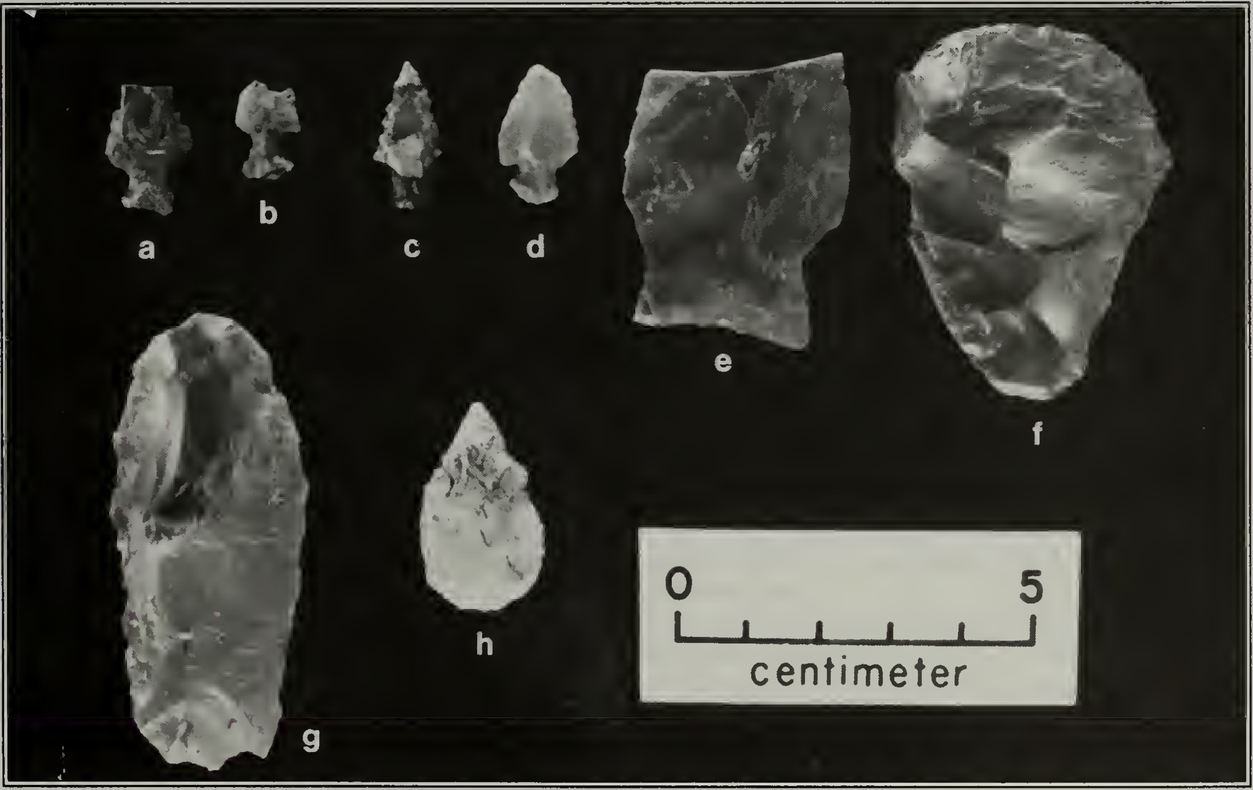

Figure 9.12 Lithics artifact from Feature 15. a.-c.Scallorn ; d.arrow preform; e.Rice Side Notched; f.side and end scraper; g.biface; h.knife; (AAS Neg # 916018).

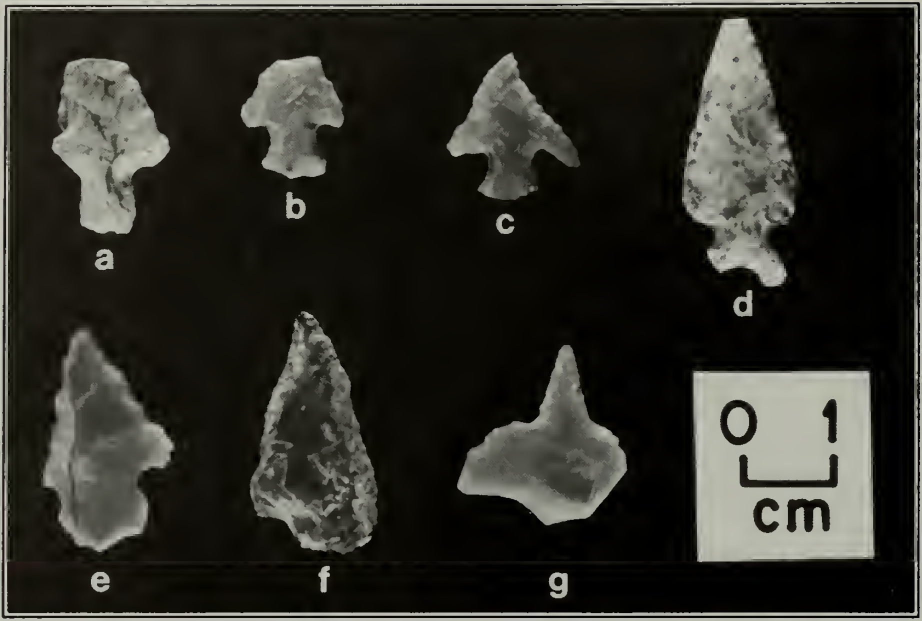

Figure 9.13 Feature 14 Flake Tools. a.,b.Scallorn; c.Agee A; d.untyped; e.,f.arrow preforms; g.awl (AAS Neg. # 915986).

Table 9.24 Heat Treated Tools, Stratum 5.

Tool Type	HT.
Arrow	7
Biface	25
Chopper	2
Core	1
Dart preform	1
Dart	9
Denticular scraper	1
Graver	1
Knife	6
Tested cobble3	2
Pitted stone	2
Modified flakes	9
Spokeshave	1
Unprepared core	4
Total	71

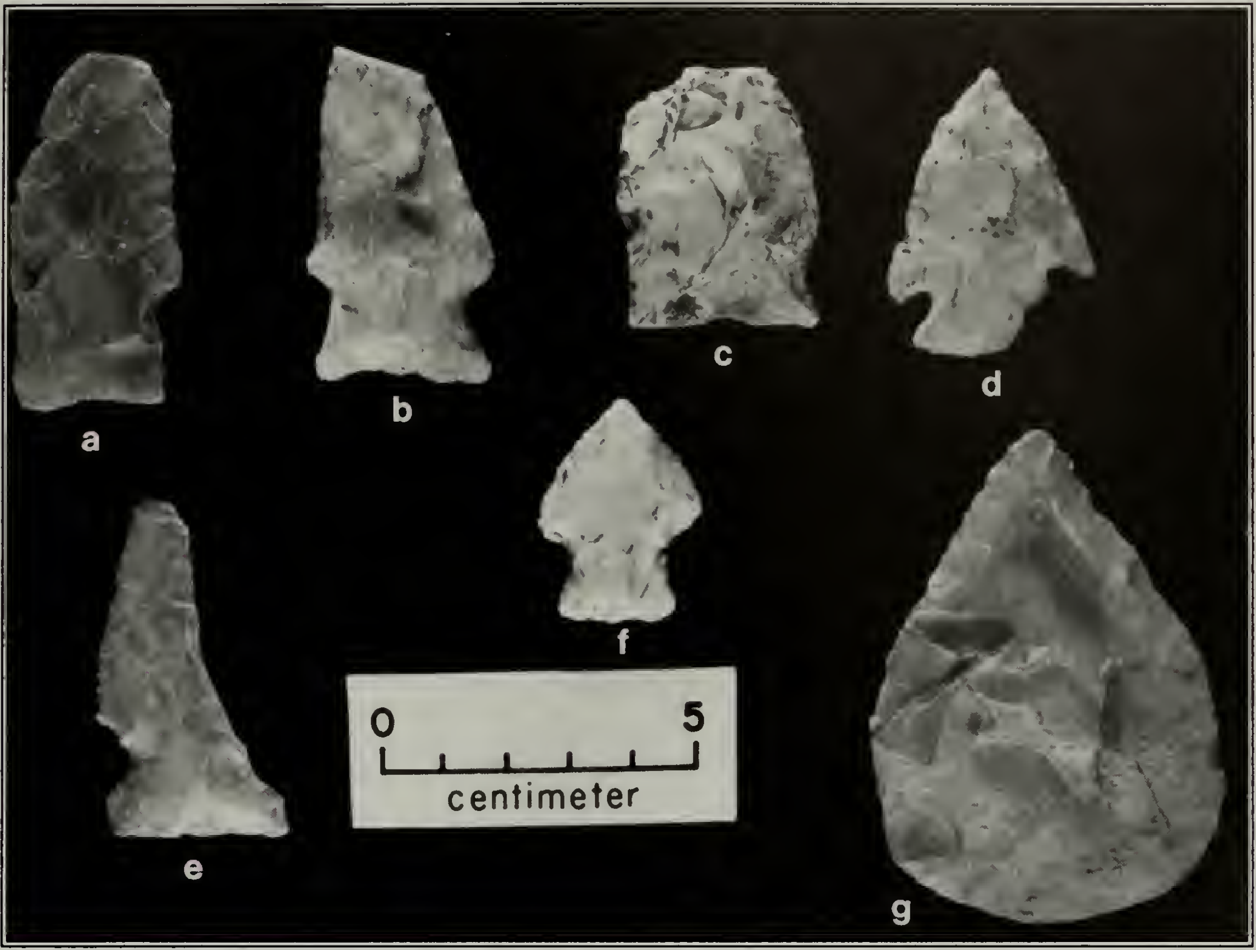

Figure 9.14 Feature 14 Lithic Tools. a.-c.Rice Side Notched; d.Castroville; e.-f.unidentified darts; g.knife (AAS Neg. # 916031).

1988 collections, also in small numbers. The other more distant lithic sources, Cotter and Jefferson City cherts, do not seem to have been used for tools making.

The 1990 debitage assemblage is consistent with the pattern identified from the 1988 collection. The flake and shatter categories (Table 9.27, 9.28) indicate that the Boone cherts produced significantly higher proportions of waste than the other material types. Sabo thought that this might indicate a shift away from heat treating the Boone types prior to knapping, a departure from the Early Woodland pattern. The size grade data for both categories supports this suggestion. The presence of chert debitage in the size grades above 2.54 cm indicate that larger chunks of chert were being brought to the site for reduction, and quarrying rather than utilization of only small expediently gathered cobbles seems to be indicated. In the 1988 assemblage the larger size grades were in the Boone, St Joe and Reeds Spring types. The same pattern is seen in the 1990 data. However, a larger amount of quartzite shatter and flakes are also present in the 1990 sample in the larger size grades. This implies some on-site working of this material, though finished artifact fragments are rare. It may therefore be the case that quartzite was a special category of material, perhaps used to make finished artifacts for trade or other special use.

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The overwhelming majority of shell-tempered ceramics were plain surfaced. Brushing, incising, engraving, linear punctation and cord impression were decorative techniques identified in the assemblage, but represented in very small amounts. Most of the decorations were on sherds 2.54 cm or smaller and thus it is not possible to do anything other than to indicate presence or absence of these forms of decoration (size grades 2.54 cm and greater are illustrated in Figures 9.15-9.17).

Table 9.25 Chipped Lithic Artifacts by Raw Material, Stratum 5.

	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	CRT	SS	TOTAL
Arrow	28	13	1	11	8	2		7				12			82
Arrow preform		3	1	6	5	2		1							18
Drill/Awl			1			1									2
Knife	9	5	1	7	6	8		1				11			48
Pebble core	2	4	2	4	6			1				2			21
Modified flake	109	124	34	189	115	109		10	1	13	2	112			818
Unprepared core	12	8	3	16	13	11					1	7			71
Adze		1													1
Adze-Like		1				1		1				1			4
Biface	57	56	1	65	21	48		21		3	6	72			350
Blade	1	2		2	7	3		1				3			19
Chopper	4	3	1	1	2							2			13
Core	3			8				1				4			16
Dart	14	12		10	8	3		20			3	17			87
Pebble tool	1	1			1							2			5
Shaper	1	3		6		1		1				1			13
Tested pebble		3		1	2			1				1			8
Cobble tool	3	1										1			5
Denticulate scrapper	1					1			1						3
Drill/perforator	1			1					1						3
Spokeshave	2														2
Tabular core	2			6	2	4						4			18
Tested cobble	8											1			9
Side/end scrapper	1	1						1				1			4
Awl				2		1									3
Celt preform				1											1
Dart preform				1	2					1					4
Drill				1	1										2
End scraper		1		1								2			4
Graver	1														1
Perforator/graver	1														1
Total	261	242	45	339	199	195	0	67	3	17	12	256			1636

Three aspects of this ceramic assemblage are of special regional importance. First; the plain, shell-tempered ceramics are not the type Mississippi Plain. Until the excavation of 3MR80, all plain shell-tempered sherds were, by definition, assignable to this type. However, the Middle to Late Woodland age of these sherds suggests that a separate antecedent type needs to be defined. Second; the collection contains a total of nine flat shell-tempered bases (Table 9.29, Figure 9.16). Flat grog-tempered bases are a marker of the Woodland period in the Ozarks and two examples are also present in these collections. It thus appears that the vessel base forms remained the same even as new tempering agents were experimented with. Third; the few sherds that were large enough to indicate the vessel form were jars or bowls. The rim profiles of the ceramics were flattened, straight sided or slightly everted (Figure 9.18) and are consistent with the 1988 rim profiles (Sabo 1990:262,263). This vessel form and rim profile are also consistent with Woodland period, grog-tempered ceramics. The ceramics .pa from Stratum 5 thus appear to be traditional Woodland period forms with a new tempering agent, shell, substituted for grog.

Table 9.26 Modified Flakes by Weight (g) and Raw Material, Stratum 5.

Size Grade	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	TOTAL
5.08	-	-	-	110.7	-	-	-	-	-	-	-	-	110.7
3.81	91.9	-	-	33.2	-	23.1	-	-	-	-	13.2	-	161.4
2.54	413.8	163.9	5.6	209.9	148.0	207.3	-	-	-	-	-	107.9	1256.4
1.27	268.2	332.5	172.8	623.3	332.7	430.0	9.3	43.6	3.7	58.6	3.4	387.3	2665.4
0.64	6.5	16.1	0.6	3.3	2.0	-	-	-	-	-	-	8.3	40.4
Total	780.4	512.5	179.0	980.4	484.3	662.4	9.3	43.6	3.7	58.6	16.6	503.5	4234.3

Table 9.27 Flakes by Weight (g) and Raw Material, Stratum 5.

Size Grade	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	TOTAL
5.08	143.3	-	-	110.7	-	-	-	-	-	-	-	-	260.0
3.81	728.4	-	53.8	33.2	-	23.1	-	-	-	-	73.2	239.5	1151.2
2.54	1783.6	502.3	161.8	698.1	388.2	490.1	-	19.4	-	-	703.1	-	4746.6
1.27	5934.1	2897.3	2364.2	4193.0	3529.1	4866.8	115.5	519.9	65.4	183.4	155.7	5140.8	29965.2
0.64	3869.3	2484.2	1338.2	3341.6	3032.4	2195.8	64.8	662.1	27.9	157.5	183.6	5763.7	23121.1
Total	12464.7	5883.8	3918.0	8376.6	6949.7	7575.8	180.3	1201.4	93.3	340.9	1115.6	11144.0	59244.1

Table 9.28 Shatter by Weight (g) and Raw Material, Stratum 5.

Size Grade	LBOONE	GBOONE	BBOONE	STJOEG	STJOEJ	REEDSG	REEDSB	PITKIN	COTTER	JEFCIT	QZIT	UNID	TOTAL
5.08	1222.0	-	-	-	-	-	-	-	-	-	699.5	-	1921.5
3.81	331.3	-	-	-	-	24.7	-	-	-	-	256.0	257.7	869.7
2.54	1473.7	53.1	-	157.7	49.6	18.6	-	63.4	-	-	437.2	894.0	3147.3
1.27	3055.5	527.6	230.1	434.9	624.3	271.9	17.7	152.8	12.9	18.9	363.1	1491.2	7200.9
0.64	1010.4	380.7	138.1	451.2	336.0	110.5	1.2	78.7	1.4	19.2	61.1	975.9	3564.4
Total	7092.9	961.4	368.2	1043.8	1009.9	425.7	18.9	294.9	14.3	38.1	1816.9	3618.8	16703.8

Table 9.29 Ceramics, Stratum 5.

Temper	Sherd Catagory	N	Percent
Shell	Rim	15	02
	Body	418	68
	Base	8	01
	Coil	2	0
Grog	Rim	12	02
	Body	145	23
	Base	2	0
Grit	Body	1	0
Sand	Body	1	0
Grog/Grit	Body	6	01
Grog/Shell	Base	1	0
Grog/Sand/Grit	Body	1	0
Sand/Grit	Rim	1	0
	Body	1	0
Shell/Grit	Body	2	0
Shell/Sand	Body	2	0
Total		616	100

Unclassified sherds (less than 1.27 cm) = 852

Middle to Late Woodland Period Component Summary.

The thick dark midden deposit of Stratum 5 contains the most abundant remains of prehistoric peoples on the site. The midden built quickly, probably over a period less than a few hundred years at most. Five radiocarbon dates from four features in the midden tightly span the Middle to Late Woodland period. The projectile point styles associated with this dated midden context also indicate occupation by a distinct cultural group. The extremely dark organic enhancement of the soil, the thickness of the midden itself, construction of large storage pits and the large quantity of artifacts left on the site bespeak an intensive year round occupation. This occupation contrasts with earlier, temporary or seasonal occupations of the site. sherds were, by definition, assignable to this type. However, the Middle to Late Woodland age of these sherds suggests that a separate antecedent type needs to be defined. Second; the collection contains a total of nine flat shell-tempered bases (Table 9.29, Figure 9.16). Flat grog-tempered bases are a marker of the Woodland period in the Ozarks and two examples are also present in these collections. It thus appears that the vessel base forms remained the same even as new tempering agents were experimented with. Third; the few sherds that were large enough to indicate the vessel form were jars or bowls. The rim profiles of the ceramics were flattened, straight sided or slightly everted

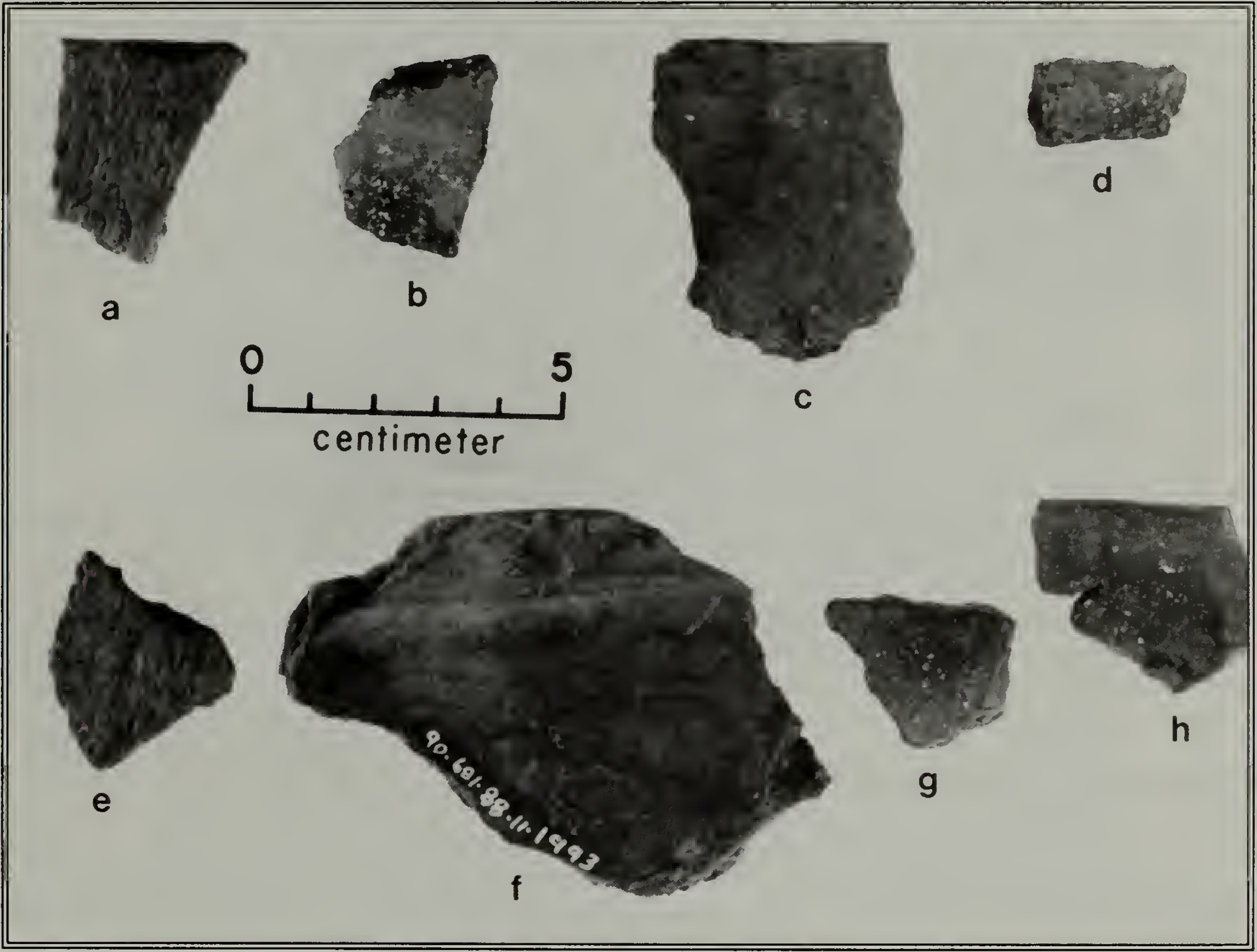

Figure 9.15 Selected ceramics, Stratum 5. a.grog-tempered cord impressed rim; b.shell-tempered plain rim; c.grog-tempered rim and bodysherd; d.shell-tempered coil; e.grog-tempered cord impressed body sherd; f.grog-tempered thickened rim; g.shell-tempered engraved body sherd; h.shell-tempered rim (AAS Neg. # 915992).

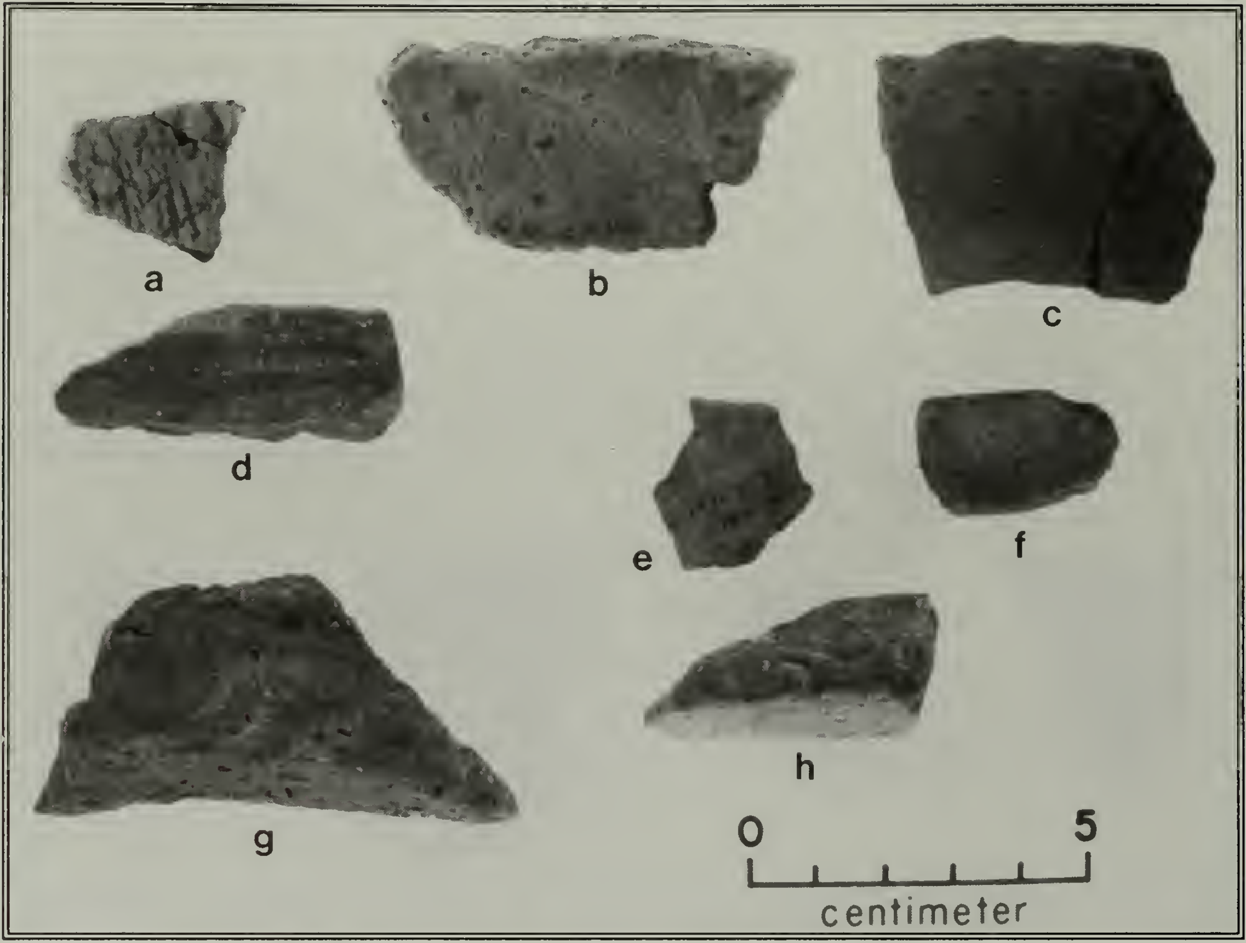

Figure 9.16 **Selected ceramics, Stratum 5. a.grog-tempered cord impressed sherd; b.shell-tempered brushed sherd; c.sand-tempered linear punctate sherd; d.shell-tempered incised rim; e.,f. grog-tempered plain rims; g.,h.shell-tempered flat bases (AAS Neg. # 916002).**

sided or slightly everted (Figure 9.18) and are consistent with the 1988 rim profiles (Sabo 1990:262,263). This vessel form and rim profile are also consistent with Woodland period, grog-tempered ceramics. The ceramics .pa from Stratum 5 thus appear to be traditional Woodland period forms with a new tempering agent, shell, substituted for grog.

Middle to Late Woodland Period Component Summary.

The thick dark midden deposit of Stratum 5 contains the most abundant remains of prehistoric peoples on the site. The midden built quickly, probably over a period less than a few hundred years at most. Five radiocarbon dates from four features in the midden tightly span the Middle to Late Woodland period. The projectile point styles associated with this dated midden context also indicate occupation by a distinct cultural group. The extremely dark organic enhancement of the soil, the thickness of the midden itself, construction of large storage pits and the large quantity of artifacts left on the site bespeak an intensive year round occupation. This occupation contrasts with earlier, temporary or seasonal occupations of the site.

Within the dark midden layer it is possible to identify two phases of feature construction during the Middle to Late Woodland occupation. The initial midden development (Figure 9.19) took place over the entire Lower Midden Area. This occupation is represented by the construction of a series of pit features (4, 10, 13 and

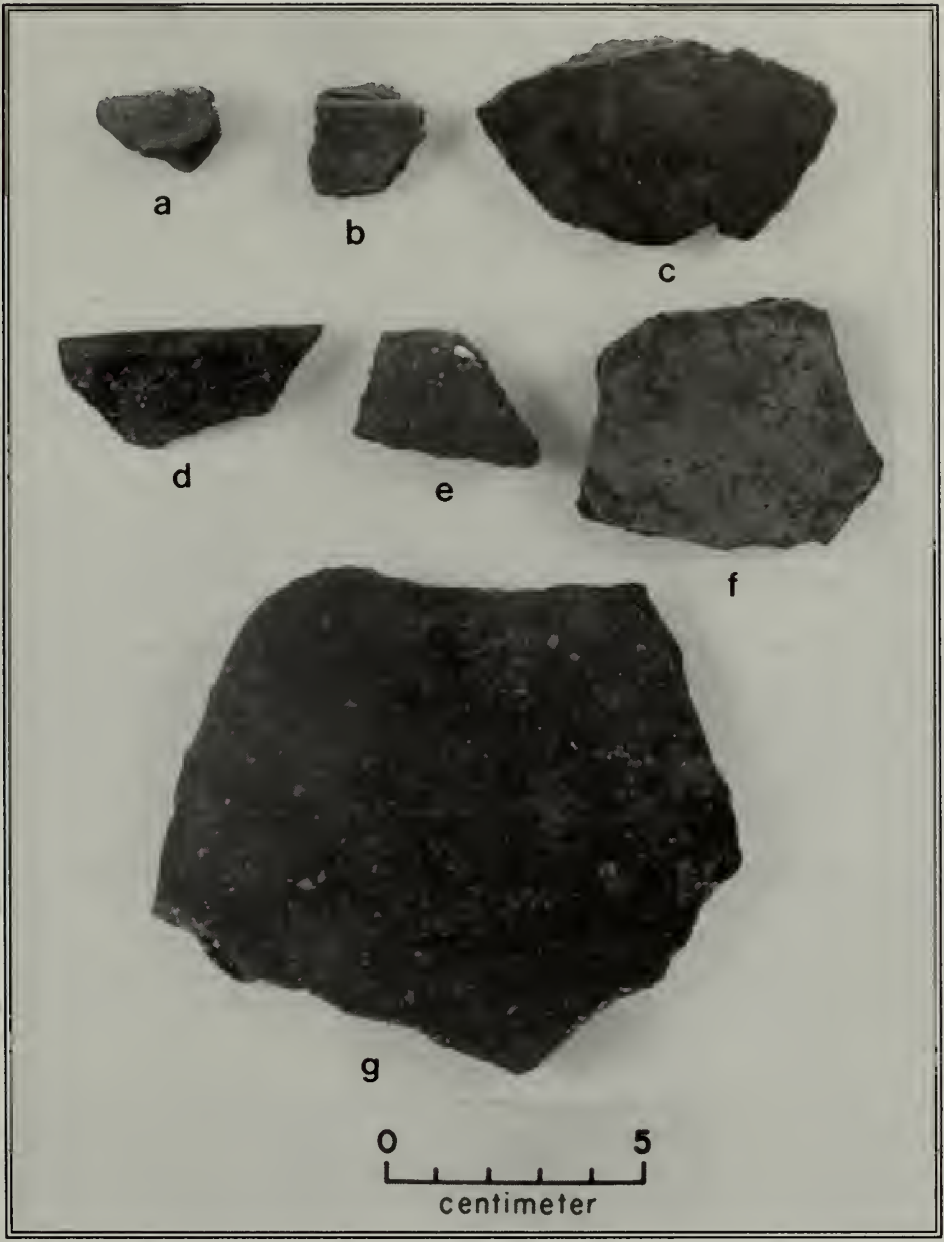

Figure 9.17 Ceramics, Features 14 and 15. Feature 14, a.shell-tempered flat rim; b.shell-tempered incised body sherd; c.grog-tempered body sherd; Feature 15, d.shell-tempered flat rim; e.shell-tempered rounded rim sherd; f.grog-tempered body sherd; g.shell-tempered body sherd (AAS Neg. # 915997).

Table 9.30 Ceramic Distribution in Features, Stratum 5.

	Temper	Sherd Category	N
Feature 10	Shell	Body	1
Feature 13	Shell	Body	9
Feature 14	Grog	Body	7
	Grog/Grit	Body	2
	Shell	Body	39
	Shell	Rim	1
Feature 15	Grog	Body	5
	Grog	Rim	1
	Shell	Body	40
	Shell	Rim	2

14) distributed around recognizable activity areas on the rock strewn surface. No evidence of house structures associated with these features was found in our excavations, although their presence is suspected.

At some later point in time, a large rectangular house was built over the now-filled pits and activity areas (Figure 9.20). This house contained a central pit, Feature 15, that may have functioned as a storage pit. A hearth somewhere in the house was the source of ash and burned earth found on the portion of the floor we excavated. Outside the structure, activity areas across the lower terrace added to the midden buildup.

The subsistence remains produced by the occupants included nuts and starchy seeds of the Eastern Agricultural Complex and a new addition, small quantities of maize. The fact that maize is in all the features is important because it suggests introduction as a food item grafted onto existing plant resources by Middle to Late Woodland times. Faunal resources include a full range of species, especially terrestrial ones. The faunal remains themselves and their method of discard suggests to the faunal analyst a possible emptying and refilling of storage pits with trash during a winter-spring season.

In addition to the introduction of maize into the diet of the inhabitants, the Middle to Late Woodland period saw another important innovation at the site: the introduction of shell-tempering as a replacement for grog in the traditional Woodland ceramic assemblage. As Sabo previously noted (Sabo 1990:274-276), this technological change in the production of ceramic vessels may have been an adaptive response to the need for vessels capable of withstanding prolonged exposure to open fire, in order to boil the domesticated grains that were now becoming an increasingly important food source.

The Middle to Late Woodland component at the Dirst Site represents several important developments culminating from earlier adaptive trends: 1) a shift from seasonal to year round settlement, 2) the construction of permanent dwellings and food storage facilities, 3) the addition of gardening to a localized hunting and gathering subsistence economy, and 4) a corresponding shift in ceramic technology involving the use of shell-tempering to produce vessels suitable for boiling domesticated grain crops over an open fire. It is apparent, however, that these developments eventually gave rise to new subsistence-settlement requirements that could not be met at the Dirst location. Apart from a minor and poorly defined early Mississippi period occupation, the Dirst Site ceased to be a locus of permanent settlement after the Late Woodland period.

The Rush Creek Phase dates from the latter Middle Woodland to Late Woodland periods. The central dates from the Dirst site cluster about A.D. 600-650 and the range of the phase falls between the fifth and eighth centuries A.D. (1450-1100 BP).

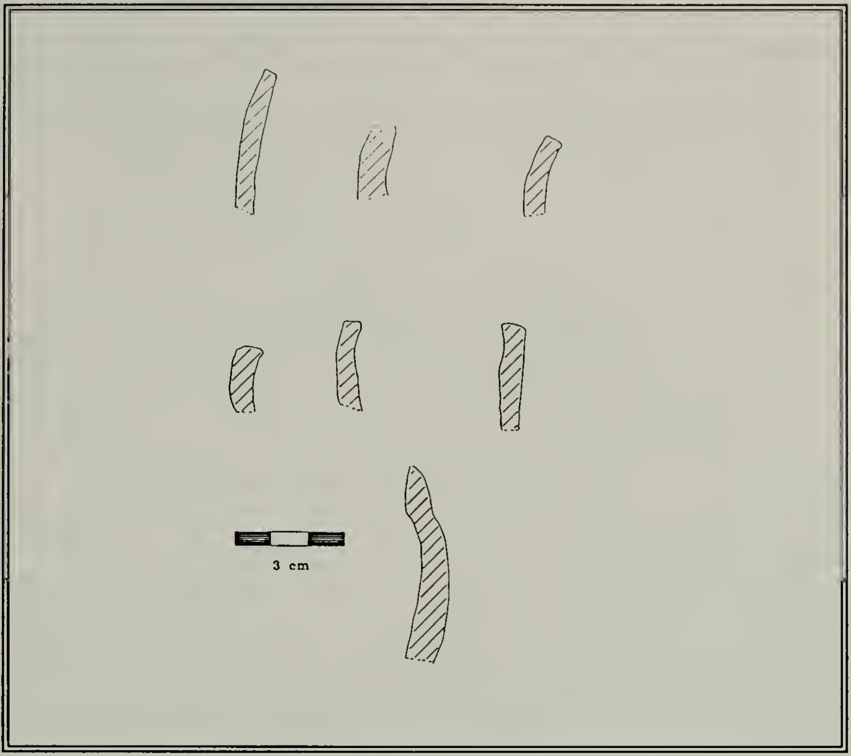

Figure 9.18 Rim profiles, Stratum 5 ceramics. Interior surfaces on the left.

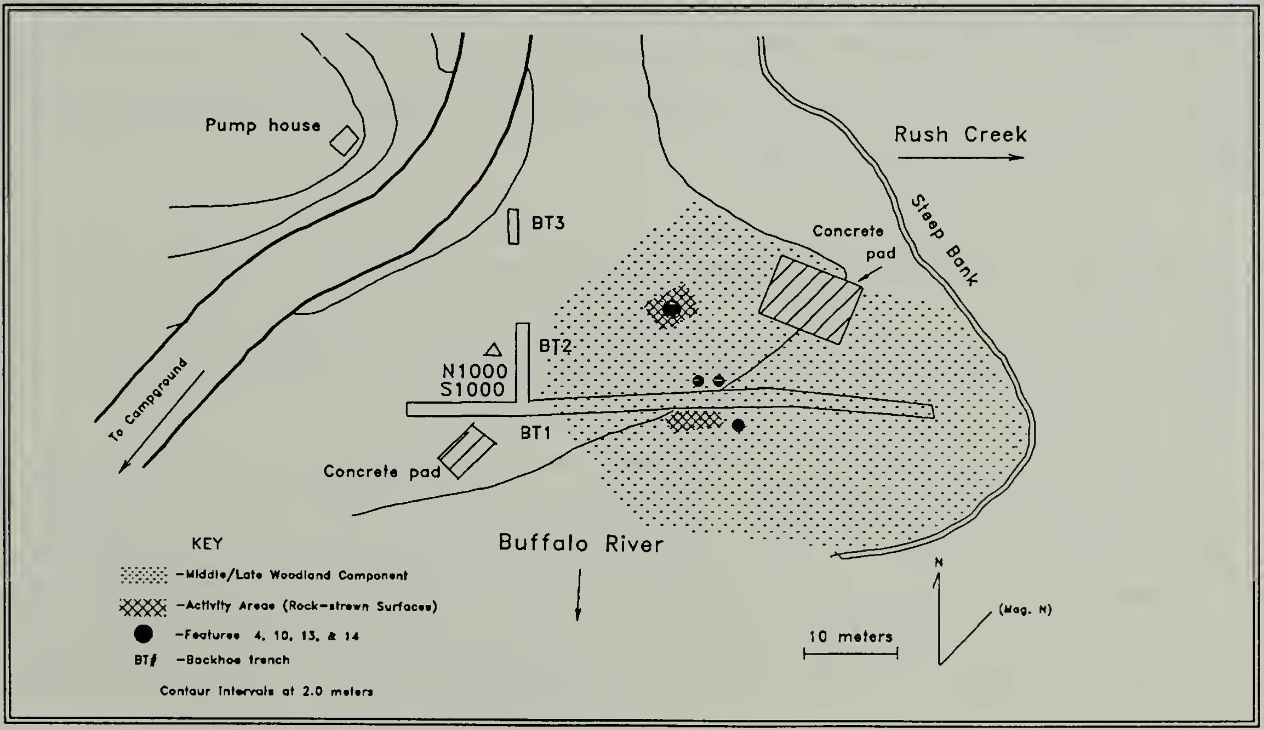

Figure 9.19 Initial midden development, 3MR80-Area D.

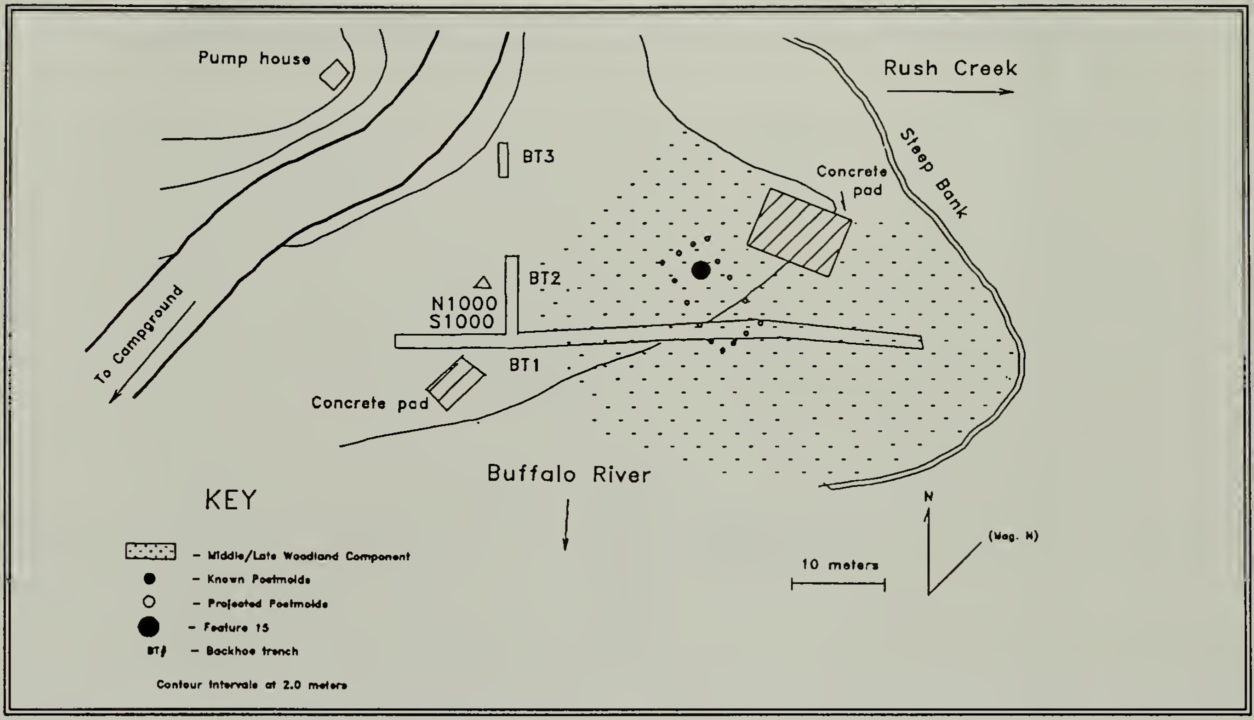

Figure 9.20 Late midden development, 3MR80-Area D.

The Rush Creek Phase peoples used a suite of projectiles, also dated elsewhere in the Ozarks to the Middle-Late Woodland periods. These diagnostic phase styles are dominated by Scallorn arrowpoints and Rice Side Notched dart points or knives, which together may constitute as much as 74% of the projectiles. Agee A and Pocola arrowpoints are included in the diagnostic phase assemblage as are Gary *var. Gary*, Gary *var. LeFlore* and Langtry projectile points. Langtry points approached 10% of the projectile point assemblage, while the other styles are between 1% to 4% of the assemblage. Other lithic items, not diagnostic of the phase, but included in the assemblage are the full range of woodworking, maintenance, manufacturing and processing tools and groundstone implements defined in the midden.

The ceramic assemblage consists of predominately shell-tempered sherds that may occur in ratios as high as approximately 3:1 over grog or other tempers. Decorated sherds are few but include brushing, incising, engraving, punctation and cord impression. Woodland period vessel forms of flat bottomed jars or bowls with straight to slightly everted rims are diagnostic of the assemblage, but occur with shell-tempered as well as grog-tempered paste. No named types are as yet associated with the Rush Creek phase. However, type varieties may be added as other sites such as Spradley cemetery (3NW101), possibly part of this phase, are analyzed.

The subsistence adaptation of the Rush Creek Phase consists of a mixed economy of hunting and horticulture as well as gathering available nuts and fruits, a pattern consistent with other contemporary societies in the midcontinent. Hunting reliance was on terrestrial mammals, predominately deer, as well as the taking of some birds, turtles and fish. Persimmon, plum, hawthorne, elderberry, sumac, purslane, grapes, black walnut, hickory, hazelnut and acorns were fruits and nuts gathered from natural stands. The plant horticulture practiced in this phase centered on a broad spectrum of plants. These included gourd, beans and squash and the starchy and oily seed producing varieties: little barley, maygrass, chenopodium, knotweed, sunflower and sumpweed. Of critical importance to the Rush Creek Phase definition is the incorporation of maize as a foodstuff on a small scale along with the earlier utilized plants of the Eastern Agricultural Complex.

The settlement pattern of the phase, so far, contains small intensively occupied year round habitations, complete with long term storage pits and permanent structures. The storage pits range in size from 440 to 672 liters. These are associated with rectangular house structures. The Dirst site may have accommodated at least one extended family whose catchment area included the Buffalo River and probably the nearby White River. Trade relations based on chert procurement and the exchange of prepared quartz crystals probably extended throughout much of the White River basin from southern Missouri to the Mississippi River.

CHAPTER 10

The Dirst Site and Central Ozarks Prehistory

GEORGE SABO III

The 1988 Arkansas Archeological Survey investigations at the Dirst Site (3MR80) produced information of exceptional quality concerning prehistoric cultural history along the Buffalo National River (Sabo et al. 1990). Additional excavations undertaken in 1990 at the Dirst site and in adjacent portions of the Rush Development Area produced significant new information that permits refinement of many of the conclusions reached in the 1988 study. In this final chapter of the 1990 project report, we first summarize major advances in our understanding of the cultural sequence preserved in Area D resulting from the 1990 program of investigations. Then we attempt to place the Dirst Site, and the Rush Creek phase in particular, into a larger regional perspective by briefly reviewing evidence concerning the development of sedentary adaptations in the central Ozarks.

Area D Revisited

The 1990 investigations in Area D were undertaken in an effort to acquire more extensive information on two apparently significant, near-surface prehistoric cultural deposits that would likely suffer adverse impacts from proposed campground construction activities. The first near-surface deposit is a portion of an extensive buried paleosol, containing Dalton and Early Archaic period artifacts, that occurs at a depth of only 50 cm below the surface. This is in a restricted area on the east side of the gravel access road crossing Area D en route to the present Rush campground. Referred to as the "Dalton Area," this near-surface occurrence of the paleosol identified in Stratum 1b was revealed during backhoe trenching operations in 1988 and further investigated during that field season by a single 2 x 2 m test unit. When exclusively Dalton and Early Archaic period artifacts were found in the paleosol stratum within that unit, it was determined that additional excavations were needed to 1) verify the existence of a discrete Dalton to Early Archaic period component in this near-surface portion of the paleosol, and 2) enlarge the sample of cultural materials representing that component to enable a better approximation to be made of the nature of the occupation. Consequently, a 4 x 4 m block was excavated in the Dalton Area in 1990.

A well-developed midden extending across the eastern half of Area D, in what has been called the "Lower Midden Area," begins about 15 cm below the modern ground surface and extends to a depth of about 60 cm in some places. This midden contains abundant cultural remains dating mainly to the Middle to Late Woodland era. Excavation of nine 2 x 2 m units in the Lower Midden Area in 1988 resulted in the collection of much important data, but two highly significant feature areas could not be completely excavated and thus further investigations were recommended. One area contained evidence suggesting the presence of a structure associated with the Stratum 5 midden deposit. Four 2 x 2 m units (referred to in this report as the "North Block") were excavated in 1990 in an effort to identify this structure. In a nearby portion of the Lower Midden Area, an arc of postmolds was found that represented part of an oval structure associated with the Early Woodland Stratum 4, directly below the Stratum 5 midden deposit. Four additional 2 x 2 m units (referred to as the "South Block") were excavated in 1990 in order to trace the remainder of this postmold pattern. The 1990 excavations also provided new information concerning cultural manifestations previously identified in the more deeply buried Stratum 2 and Stratum 3. Revisions to our understanding of the cultural sequence preserved in Area D resulting from the 1990 excavations are summarized below.

Stratum 1b: The Dalton-Early Archaic Component

Excavations into the near-surface portion of the buried paleosol in 1990 revealed that the 1988 discovery of an apparently discrete Dalton to Early Archaic component in this portion of the site was anomalous. The 1990 excavations into Stratum 1b yielded only a single temporally diagnostic artifact, a Williams point, which is best interpreted as intrusive into this stratum from the overlying Stratum 2. Furthermore, it now appears that much of the near-surface portion of the paleosol along with the overlying Stratum 2 in this area have been disturbed by natural and/or human processes that have resulted in the secondary deposition within these sediments of later artifacts and possibly other cultural materials.

Although the research potential of the near-surface sediments in the Dalton Area now appears to be exhausted, the identification made in 1988 of Dalton and Early Archaic period artifacts directly associated with the Stratum 1b paleosol remains a significant finding. No new evidence has been produced, unfortunately, to shed light on the unanswered question of whether this earliest documented occupation of the Dirst Site represents a short-term special purpose camp or a longer-term base camp -- the two most likely possibilities given our present understanding of post-Pleistocene settlement patterns in the region. It may be the case that further evidence of this occupation is preserved in the more deeply-buried portions of the Stratum 1b paleosol, in contexts that for the time being seem to be safely out of harm's way.

Stratum 2: The Early to Middle Archaic Component

In 1988 artifacts representing an Early to Middle Archaic occupation were derived from Stratum 2 in backhoe trenching operations. Limited controlled excavations into Stratum 2, unfortunately, did not produce any diagnostic artifacts to confirm the presence of this component. Excavations in unit N996/E1028 in 1990 also penetrated into Stratum 2, and this time the effort was rewarded by the recovery of a single Early to Middle Archaic diagnostic, a Big Sandy point. While the small size of the 1990 artifact sample from Stratum 2 is acknowledged, we are now able to positively identify the Early to Middle Archaic component represented in this stratum. The limited range of tool types and lack of any features or evidence of anthropic enhancement of the sediments are consistent with an interpretation of this component as representing a short-term campsite used by a small group of mobile foragers.

There can be little doubt that unexcavated portions of Stratum 2 contain additional significant remains resulting from this occupation, but fortunately the depth of this stratum is well below the project impact zone of proposed campground comnstruction activities planned for Area D.

Stratum 3: The Late Archaic Component

Excavations into this stratum in 1990 confirmed the previous identification of an associated Late Archaic component. Although the artifact sample representing this component has been enlarged, no features (such as postmolds, pits, hearths, etc.) or anthropic enhancement of sediments indicative of prolonged occupation have been noted. The range of artifact types representing this component, more extensive than that associated with the Stratum 2 component, does suggest that the Late Archaic occupation of the Dirst site might have been of somewhat longer duration than earlier occupations. Furthermore, the 1990 excavations revealed that the distribution of artifacts within Stratum 3 exhibit a pattern of areal clustering possibly indicative of separate activity areas. Both of these observations are consistent with our general picture of prehistoric cultural developments in the Ozarks that portray increasing territorial constriction and greater use of multi-season base camps on the part of Late Archaic groups. The 1990 excavations also produced a somewhat larger collection of lithic artifacts and debris made of non-local stone compared to the Stratum 3 assemblage derived from the 1988 excavations, suggesting that the Late Archaic occupants of the Dirst Site may have been more involved in regional exchange networks that previously suspected.

While additional information concerning this occupation could undoubtedly be acquired through further excavation, Stratum 3 -- like Stratum 2 -- occurs at a depth across Area D that probably will not be impacted by proposed campground construction.

Stratum 4: The Early Woodland Component

The attempt to uncover more of the circular postmold pattern discovered in this stratum in 1988 was largely unsuccessful: only two more very shallow features were identified that may represent the bottoms of postmolds that were largely destroyed. However, the 1990 excavations also identified considerable disturbance in the area where the remainder of the postmold pattern would have extended. These disturbances derived from two sources: 1) the subsequent Middle to Late Woodland occupation of the site represented in Stratum 5, and 2) erosion along the southern edge of Area D associated with the development of the large, deep gully separating Area D and Area C.

Other results of the 1990 excavations into Stratum 4 include the recovery of twig-impressed daub fragments that could represent the clay-plastered smoke hole of a presumably conical dwelling represented by the arc of postmolds. If this interpretation is correct, this evidence provides an important additional clue concerning Early Woodland house architecture in the central Ozarks.

A few artifacts post-dating the Early Archaic period were recovered during the 1990 excavations into Stratum 4, particularly in the areas where the most evidence of later disturbance was noted. However, the majority of artifacts associated with this stratum support the previous identification of an Early Woodland component. The multi-task activity profile that can be reconstructed from the associated artifact assemblage, along with the presence of the circular structure and the pronounced anthropic enhancement of the Stratum 4 sediments, support an interpretation of a multi-season base camp occupation. The lack of storage pit features, however, suggests that the occupation was not a year-round one. Identified faunal and floral remains from Stratum 4, which represent a wide range of animals and nondomesticated plants along with a few seeds from cultivated (and possibly domesticated) plants, are consistent with this interpretation.

Although Stratum 4, at an average depth of about 50 cm below the surface across much of Area D, is not likely to be severely impacted by planned construction activities, extreme caution should be taken nonetheless to prevent damage to this unique deposit -- so far the only discrete Early Woodland occupation identified in the central Ozarks.

Stratum 5: The Middle to Late Woodland Component

Much clarification of the nature of the occupation represented by the Stratum 5 midden component is possible as a result of the 1990 excavations. The Middle to Late Woodland temporal affiliation has been confirmed by recovery of additional diagnostic artifacts and by the radiocarbon dating of preserved nutshell fragments derived from three additional pit features associated with the midden component. All three radiocarbon dates fall within the A.D. 650-700 era. The calibrated ages of two radiocarbon dated samples (one on wood charcoal, one on nutshell) derived from a similar pit feature excavated in 1988 were A.D. 405 and A.D. 642 (Sabo et al. 1990:136). The fact that the dated pit features occurred in stratified contexts from the bottom to the top of the midden stratum suggests furthermore that the midden buildup and associated site occupation took place during a much shorter interval of time (possibly as little as 50 years) than we previously suspected.

The analysis by Sandra Dunavan and Susan Scott of floral and faunal remains recovered in flotation processing of the contents of pit features excavated in 1990 adds important new information that supplements our previous reconstruction of the Middle to Late Woodland subsistence economy. We are now confident in our assertion that garden production of Eastern Agricultural Complex cultigens, other non-domesticated but cultivated seed-bearing plants, and squash, gourd and maize had been added as a component (albeit probably still a minor one) of a broad-spectrum subsistence economy in which the major seasonal activities were intensive but selective hunting of deer and secondarily elk, and harvesting of nuts (especially acorns and hickories). A wide variety of smaller land animals, fish and other aquatic species, and other nuts, seeds, and fruits were added to the annual take. The occurrence of small amounts of maize in all of the pit features excavated in 1990 as well as in samples derived from the base of the midden indicates its initial adoption in the central Ozarks as a cultigen of minor economic importance, rather than a cultigen used for restricted ceremonial or other high status purposes.

In an effort to establish directly the apparent Middle Woodland occurrence of maize at the Dirst Site, a sample derived in 1988 from the Feature 4 pit at the base of the midden deposit was submitted for AMS dating. The resulting assay, with a calibrated age of A.D. 941 falling at the very end of the Late Woodland period, did not produce the earlier date we were looking for. Since tiny, carbonized maize kernels can be easily dislocated -- especially downward -- in a midden deposit such as the one present at the Dirst Site, it is most likely that the maize sample from Feature 4 that we selected for radiocarbon dating was indeed intrusive from a later context of primary deposition. Given the generally uniform dating of four pit features associated with the midden component (with four of six dates clustering around A.D. 650), and given the presence of maize in small amounts in all of these features, it would be worth the effort and expense to obtain assays for additional maize samples.

The distribution of faunal and floral remains and associated taphonomic considerations has also led to identification of a likely pattern of fall and winter refuse disposal (consisting mainly of deer and elk remains) across the surface of the site, accompanied by springtime cleanup and disposal of refuse (consisting of a wider range of species remains, including fish and other aquatic species) into newly-emptied food storage pits. The distribution of wood charcoal, in which significantly greater amounts occurred in refuse pits than in the midden, also supports this interpretation of seasonal changes in refuse disposal practices and storage pit utilization.

New insights concerning plant production and harvesting practices and the capture and processing of various animals are provided in the chapters of this report authored by Dunavan and Scott. The expanded faunal sample, in particular, makes it possible now to refine our assessment of Rush Creek phase subsistence organization. Traps, spears, and weirs appear to have been the implements and facilities most likely used to acquire fish, given the sizes of fish represented in the faunal sample. Butchering marks on deer and elk bone suggest frequent disarticulation of frozen carcasses, indicating the importance of the fall and winter catch. The frequency and distribution of elk remains further suggests that this species was taken opportunistically in the context of deer hunting; the resulting large quantities of meat were probably shared beyond the immediate family or household group. Smaller than expected frequencies of certain long bones suggests that the meat attached to some of these bones was roasted, while other long bones may have been purposefully broken to produce bone grease. Similarly, the paucity of deer and elk thoracic vertebrae indicates that meat attached these bones may have been boiled. Finally, the shattering of large quantities of deer bone indicate a preference or need for extracting considerable quantites of marrow. Although a wide variety of small animals were also taken, none of these species occurs in quantities suggesting an emphasis on second-line resources. Correspondingly, the apparent selective focus of deer hunting, in which larger animals were preferentially taken, suggests that the overall subsistence organization was a highly successful one.

Additional settlement pattern data derived from the 1990 excavations further enhances our understanding of the nature of the Middle to Late Woodland occupation and the activities resulting in the rapid buildup of the midden. The combined 1988 and 1990 excavations identified a series of refuse-filled storage pit features (Features 4, 10, 13, and 14) distributed around separate activity areas represented by concentrations of broken rock at the base of the Stratum 5 midden unit. These features represent the initial series of activities contributing to the midden buildup, and although none was positively identified, it is likely that at least one dwelling was present in Area D at that time. Later, at least one square or rectangular structure was erected, the corner of which was identified from a series of postmold features encountered higher up in the midden. This dwelling had at least one internal storage pit (Feature 15), and ash and burned earth scattered on the exposed portion of the floor indicated the presence of an internal hearth. The overall size of the Lower Midden Area is such that more than one or two additional structures associated with this one would be highly unlikely.

The enlarged ceramic sample derived from the midden component as a result of the 1990 excavations adds significant information concerning the shift from grog to shell tempering of pottery in the central Ozarks during the Middle to Late Woodland era. The majority of sherds are smooth-surfaced and undecorated, although minor amounts of brushed, incised, engraved, linear punctated, and cord-impressed decorations are represented. More importantly, vessel shapes seem to be limited to flower-pot jars with straight to slightly everted rims and shallow bowls with slightly inverted or everted rims. Thus it appears that the Woodland shell-tempered vessels at the Dirst site do not differ much in form from earlier grog-tempered ceramic vessels found in the central Ozarks. Further analysis of this sample and comparison with other Woodland and Mississippi period, shell- tempered ceramic collections from central Ozark sites will undoubtedly necessitate the designation of new types and varieties.

Results of the 1990 excavations in the Lower Midden Area also helped to clarify the nature of the later Mississippi period occupation represented by a small number of diagnostic arrowpoints and a single radiocarbon date (calibrated age: A.D. 1217) obtained on a charcoal sample from a feature excavated in 1988. Based on the radiocarbon dating of pit features excavated in 1990, the expanded settlement pattern data for Area D, and the 1990 testing of Area A (where a previously suspected Mississippian component was not identified), it now appears certain that the Dirst site was used only for short-term occupation during the Mississippi period. The main locus of permanent occupation had evidently shifted elsewhere. Following this shift, the Dirst site was apparently used only on a short-term basis, presumably for some specialized purpose such as seasonal fishing.

Information on the locational characteristics of the Dirst Site, derived from Guccione's reconstruction of the geomorphology of the Buffalo River presented in Chapter 4 of this report, provides a plausible explanation for this apparent shift in settlement location during the Mississippi period. Using information from field studies at archeological sites and data derived from topographic and soils maps, Guccione developed a model of the valley floor along the entire course of the Buffalo National River which permits assessment of the potential for surface and buried archeological sites to exist in specific localities. Only along the lower stretches of the Buffalo River (in which the Rush Development Area and the Dirst Site occur) are there multiple terrace series that provide a setting for deeply buried sites and extensive stratified cultural deposits such as those identified at the Dirst Site. However, the narrow width of the valley along this portion of the river limits not only the number of areas available for human occupation but also the distribution of productive soils. Therefore, on the basis of Guccione's study we may suggest that as the production of domesticated plants increased during the Mississippi period, the more extensive distribution of fertile soils in the wider valleys of the upper Buffalo River would have exerted a "pull" on settlement location choices resulting in the abandonment of the Dirst Site as a year round habitation. The locations of the Elk Track Site (Lafferty et al. 1988a) and 3NW539 (Limp 1989), both of which represent sedentary Mississippian settlements where maize was grown, provide support for this interpretation. The Elk Track Site is located along Segment 4 of the river and 3NW539 is located along Segment 3 (Guccione, this volume), where the floodplain is relatively wide and supports a distribution of productive soils that is considerably more extensive than that found in locations farther down the river.

The near-surface sediments comprising Stratum 5 contain some of the most important archeological remains yet discovered in the central Ozarks. Although we have learned much from the 1988 and 1990 excavations, the remaining undisturbed portions of the Lower Midden Area must still be regarded as a significant cultural resource. In addition to the certain extensive artifact and ecofact content of the midden itself, there is every reason to believe that additional features remain within the Lower Midden Area, including pits, structural remains, and possibly human burials. Therefore, construction of campground facilities in Area D should proceed with due caution and with the goal of preserving intact and protecting as much of the Lower Midden Area as possible. If excavations into the Lower Midden Area are necessary, there should be an appropriate level of monitoring conducted by trained personnel.

Origins of Sedentary Adaptations in the Central Ozarks

The 1988 and 1990 investigations at the Dirst Site documented six prehistoric cultural components in five discrete strata contained in Area D. These components are summarized on Table 10.1.

The 1988 investigation produced an assessment of this cultural sequence in terms of five aspects of cultural change: 1) changes in settlement types represented at the Dirst Site; 2) changes in lithic raw material selection through time; 3) developing trade/exchange patterns involving lithic raw materials; 4) the evolution of pottery making technology; and 5) adaptations to domestic plant production (Sabo et al. 1990:269-83). In general, the archeological record preserved at the Dirst Site portrays a gradual shift from a mobile, foraging lifeway established during the Dalton period to a Middle to Late Woodland sedentary lifeway supported by a broad spectrum subsistence economy based on a mixture of hunting, wild plant gathering, and gardening. Sedentary lifeways continued into the Mississippi period although the locus of permanent habitation had shifted away from the Dirst Site, which was then used only for temporary, special purposes. Accompanying the shift from mobile to sedentary settlement was an important technological development -- the use of shell-tempered pottery -- and there was also an intensification of participation in supralocal trade and exchange networks that were well established by Late Archaic times, if not earlier.

Table 10.1 Cultural Components Identified in Area D at the Dirst Site

Stratum	Component	Inferred Settlement Type
1a	Dalton to Early Archaic	short-term camp (?) of mobile foragers
2	Early to Middle Archaic	short-term camp of mobile foragers
3	Late Archaic	base camp of constricted area foragers
4	Early Woodland	base camp of semi-sedentary forager/plant cultivators
5	Middle to Late Woodland	year-round household of sedentary foragers and gardeners
5	Early Mississippian	special-purpose camp of sedentary foragers and gardeners living elsewhere

Comparison of Woodland period developments at the Dirst Site with contemporaneous trends in adjacent regions indicated that late prehistoric populations residing in the Central Ozarks were active participants in the same cultural developments that characterize the Woodland to Mississippian transition across the American midsouth. The suggestion was made that the processes underlying this transition involved both internal (local) and external (supralocal) developments that produced a regionally distinctive variation on a larger Mississippian cultural theme (Sabo et al. 1990:319-28).

These aspects of Emergent Mississippian development in the central Ozarks can be understood as the culmination of cultural trajectories originating in the preceding Archaic and Woodland periods. What appears to be the most fundamental aspect of the cultural sequence represented at the Dirst Site is the shift from a mobile foraging lifeway to a sedentary lifeway based on a mixture of foraging and gardening. The combined results of the 1988 and 1990 investigations at the Dirst Site permit further consideration of this transformation and the mechanisms and processes by which it may have come about.

The shift from mobile to sedentary settlement basically involves reduction in the mobility of a group of people to the point where they remain residentially stationary year-round (Hitchcock 1982:223). Thus sedentary settlement systems may be defined as "those in which at least part of the population remains at the same location throughout the entire year" (Rafferty 1985:115). Anthropologists studying processes leading to sedentary settlement have become increasingly aware of the need to make an analytic distinction between this shift and other processes involved in the origins of agriculture, as the two phenomena appear to be independent in many cases (e.g., Flannery 1972).

Why do shifts from mobile to sedentary settlement systems occur? For human groups supported by a foraging subsistence economy, sedentism has many disadvantages, including increases in competition over resource areas, increases in scheduling and managerial requirements, increases in interpersonal conflicts, increases in labor requirements, and increases in malnutrition and disease. Yet in many parts of the world the shift to sedentism actually preceded the shift to economies based on domesticated plants and animals (Harris and Hillman 1989). Thus it may be argued that under certain conditions mobile foragers may perceive benefits to be gained from a shift to a sedentary pattern of settlement. The key to understanding the origins of sedentism therefore appear to lie in determining what kinds of conditions bring about these perceived needs to change, and how foraging populations organize their responses to those conditions.

According to Hitchcock, arguments about the origins of sedentism can be separated into four basic categories, each postulating a different causal determinant: 1) climatic change arguments, 2) resource abundance and/or diversity argument, 3) demographic arguments, and 4) social causality arguments (Hitchcock 1982: 227-230). Hitchcock further observes that there are two main contexts in which mobility reduction comes about: primary or in situ sedentism and secondary or contact sedentism. His comments on the origins of primary sedentism are germane to present concerns:

> Primary sedentism, occurring in certain parts of the world 10,000 or more years ago, came about when groups took advantage of highly nucleated and abundant resources. Simple availability of these resources, however, was insufficient to bring about residential stability for an extended period of time without techniques which could enable the extension of the use-life of those resources... Long-term residential stability comes about when a group's mobility options are restricted due to the fact that there are too many other groups occupying the habitat. Regional saturation resulting in range restriction can occur as a result of long-term slow rates of population growth or as a result of in-migration. As the number of groups in a region increases, there would be an increased trend toward localized settlement and perhaps territorial demarcation (Hitchcock 1982:231-32).

Thus Hitchcock identifies resource structure, environmental change, and population pressure as key variables operating in the emergence of primary sedentism. Of course, these variables permit a wide latitude of conditions to arise, at equally widely varying rates, that could have prompted mobile foragers to reorganize their settlement strategies. While the shift from mobility to primary sedentism was undoubtedly a drawn-out and complex process in most instances, the outcome in most if not all cases was basically to provide alternative ways to concentrate resources or relocate resources within an area permanently inhabited by a population, rather than moving the population that depends on those resources (Rafferty 1985:120).

Turning now to the American midsouth and the central Ozarks in particular, the general pattern of post-Pleistocene cultural development is one of perhaps slow and intermittent but nonetheless overall increase in human populations throughout the Archaic period (Sabo et al. 1988). The identification of regional cultural phases, especially by Late Archaic times, provides evidence of the trend mentioned by Hitchcock toward localized settlement and territorial demarcation by individual groups. Accompanying this trend was a separate but parallel trend toward increased dependence upon a limited range of locally available resources, such as deer, nuts, or shellfish, albeit usually as part of a broader-spectrum subsistence economy. The cultural sequence documented in Area D of the Dirst Site corresponds to this general trend.

According to Smith (1987, 1989), conditions prompting mobile foragers to adopt more intensified and specialized subsistence strategies developed during the early to middle Holocene epoch, when large scale climatic changes brought about widespread reduction of useful subsistence resources in upland habitats, thereby pulling human populations in increasing numbers into major riverine areas. As stream channels began to stabilize, floodplain ecosystems developed that contained rich resource concentrations. In the central Ozarks, floodplain environments are more restricted in frequency and extent (Guccione, this volume), but the highly variegated topography yields a variety of microenvironmental zones in close proximity to floodplain settings, some of which are also quite rich in resources useful to human populations.

Following Rindos (1984), both Smith (1987, 1989) and O'Brien (1987) have argued that resource specialization began in the American midsouth during the Archaic period. Accompanied by territorial restriction of settlement patterns, this led to increases in the average length of occupations at base camps, which in turn resulted in the development of disturbed anthropogenic habitats. These habitats, according to Smith, became "domestilocalities" where mutualistic relationships developed between adventitious seed-producing plants and human populations. According to Rindos' coevolutionary model, natural selection pressures increased the relative fitness of human and wild plant populations, giving rise to the eventual domestication of some of these plants. Rindos' model provides an explanation for the origins of plant domestication that accords well with the archeological record in the American midsouth, where indigenous domestication of Eastern Agricultural Complex plants is now well-documented (Smith 1989; Watson 1989). Fritz (1986, 1990) has argued in favor of this model for tracing the origins and development of plant domestication in the Ozarks, and the evidence concerning changing subsistence and settlement patterns at the Dirst Site provides additional support. However, while Rindos' model provides valuable insights into the processes by which plant domestication originated in the midsouth, it does not address the cultural mechanisms that ultimately gave rise to the shift from a mobile, foraging lifeway to a sedentary lifeway based on foraging and gardening (e.g. Chase 1989).

The cultural sequence at the Dirst Site, along with the distribution of other multicomponent sites in the Rush Development Area (e.g. 3MR51, 3MR52) and in adjacent portions of the lower Buffalo River, indicates that through time changes were made in settlement strategies to locate larger numbers of people in closer proximity to the multiple resource zones accessible from the site. The replacement of the dart by the bow and arrow, the development of fishing technologies, and the advent of nut storage techniques furthermore represent technical innovations that were employed to increase the yield of animals and wild plants previously acquired in lesser quantities via more extensive seasonal movements. This subsistence economy was broadened by the addition of Eastern Agricultural Complex cultigens (which are in evidence at the Dirst Site by the Late Archaic period) grown in gardens, to which squash, gourd and corn were later added. The development (also by Late Archaic times) of specialized processing and storage techniques for seeds (Fritz 1986) and nuts (Hilliard 1980, 1986) served to extend the availability of wild and cultivated plant foods into nonproductive periods of the year. Thus by the time the Dirst Site was occupied by its Rush Creek phase inhabitants, the net effect of these developments was a significantly increased ability on the part of a stationary population to maintain the year-round availability of a selected range of subsistence resources that were produced and/or acquired on a seasonal basis.

What cultural factors promoted these developments? In a recent publication, James A. Brown (1985) has suggested that the development of sedentary adaptations in the American midwest can perhaps best be understood in terms of changes in the risk-management strategies upon which mobile settlement patterns are based. This suggestion accords with the observation made earlier that the key to understanding the origins of sedentism appears to lie in the study of conditions prompting changes in mobility patterns and the manner in which foraging populations organized their responses to those conditions. Risk-management strategies (that is, strategies employed to avoid or circumvent anticipated problems that may effect a local group and hinder its ability to sustain itself as a cohesive functioning community) are necessary components of all cultural systems. While these strategies may sometimes employ technological means (for example, using storage facilities to extend the seasonal availability of selected resources), they inevitably depend upon social arrangements and institutions (stored food, for example, must eventually be shared within or between socially recognized and sanctioned groups). In short, risk-management strategies are inevitably social strategies.

Anticipating Smith's arguments for the origins of plant domestication in eastern North America cited above, Brown suggests that broad patterns of environmental change and population increase began to limit the risk-reducing advantages of residential mobility for Archaic foragers in the American midwest, culminating in a major reorganization of strategies by the Woodland era. Specifically, as populations increased and as more and more groups became "packed" into smaller and smaller areas, risk-management strategies based on unbounded residential mobility brought increasing risk of conflicts with other local groups. At the same time, intensification of resource production within local settlement areas became increasingly necessary to support local populations. Sedentism thus became a viable strategy for managing social and subsistence risks when population and resource distributions reached a point at which continued residential mobility engendered a high probability of intergroup conflict and other social problems (Brown 1985: 208).

In the American midwest and the midsouth, one of the most pervasive changes in risk-management strategies that attended the emergence of sedentism was an intensification of social networks connecting local groups on a subcontinental scale in order to serve many community needs, not the least of which was to maintain territorial integrity and at the same time override local variations in the distribution, abundance, and predictability of critical subsistence resources (e.g., Bender 1985; Braun 1986; Braun and Plog 1982). For Brown, sedentism thus can be seen as the outcome of "cumulative efforts of individual groups to maintain intergroup spacing in those situations in which resource abundance makes this a relatively inexpensive option requiring minimal technological innovation" (Brown 1985: 224). In sum, while resource structure, environmental change, and population growth are important variables in tracing the origins of sedentism, decision-making in risk management is the specific mechanism that promotes the shift away from residential mobility.

The Rush Creek phase occupants of the Dirst Site appear to have been involved in trading a variety of resources with populations inhabiting adjacent regions. Occupants of the central Mississippi Valley area were dependent upon Ozark sources for a variety of lithic materials at this time period (Morse and Morse 1983: 205). The occurrence at the Dirst Site of cherts and quartzite from southern and central Missouri sources suggests a northward extension of trade relations as well. Dirst Site debitage reflecting the trimming of quartz crystals, coupled with the absence of whole quartz crystals at the site, also suggests te export of that material to other locales. Consumers of quartz crystal during this period include central Mississippi Valley residents (Morse and Morse 1983) and the Plum Bayou culture people of the central Arkansas River Valley (Rolingson 1982). Finally, the selective pattern of Rush Creek phase deer and elk hunting centering on procurement of large size animals also suggests that meat and/or hides were exported from the site. While this pattern of deer and elk predation was undoubtedly related in part to the general subsistence needs of the group occupying the Dirst Site, it is possible that basic caloric needs were supplied by other components of the subsistence economy, thereby "permitting hunters to indulge in higher risk procurement strategies such as large mammal hunting" (Speth and Scott 1989: 78). In sum, there is good evidence at the Dirst Site, beginning in Late Archaic times, for increased participation in supralocal trade and exchange networks that reached an apex of development during the Middle to Late Woodland Rush Creek phase occupation.

The implication of this participation in supralocal trade and exchange networks for consideration of changing risk-management strategies is that by the time the Rush Creek phase occupation of the Dirst Site took place, a need had developed for two important forms of managerial activity: one involving the scheduling of logistical strategies for the production and acquisition of resources from diversified but closely accessible resource zones; the other involving the organization and actual conduct of supralocal trade and exchange activities. In mobile foraging societies, the same managerial needs exist (though in a more incipient form), but they are generally served by individuals who assume leadership roles in addition to their participation in basic productive activities. When these managerial roles increase in importance and become part of the risk-management strategies of sedentary populations, it becomes necessary to separate the respective roles and activities of producers and managers. That is, specialized managerial or leadership statuses become institutionalized, and these form the basis for the subsequent elaboration of ranked social systems.

Although we have no evidence for pronounced social differences among central Ozark populations during Woodland times, production demands on the Rush Creek phase occupants of the Dirst Site evidently were increased in relation to the activities of full-time managerial specialists. As noted previously, the basic food needs of the local group were most likely met by increased utilization of storable plant foods including seasonally harvestable nuts and garden produced cultigens, both of which require intensive production efforts only at sporadic and predictable intervals. Production of resources for trade and exchange purposes -- cherts and quartz crystal, meat and hides, etc. -- would likewise require only certain adjustments be made in the logistical organization of basic subsistence routines, particularly in the scheduling and organization of hunting and gathering activities. In sum, increased production of food resources and production of goods for trade and exchange would have mainly created a need for increased attention to the scheduling and organization of basic resource production activities in order to bring these activities into articulation with the demands of participation in interregional trade and exchange networks. As noted above, this need would have been filled by managerial specialists, who were perhaps the same individuals involved in supralocal trade and exchange activities.

If institutionalized forms of leadership did indeed emerge with the shift to sedentism reflected in the Rush Creek phase occupation of the Dirst Site, then we must inquire whether status or rank accorded these individuals is reflected in the archeological record. At the present time, we lack any evidence indicating the existence of elevated status or rank within the Rush Creek phase community. Archeologists usually turn to mortuary data to address questions concerning status and rank within societies that do not engage in the construction of monumental or other specialized architecture. Individual interments as well as cemetery organization can sometimes provide valuable information concerning the forms of past social organizations. Since we know so very little about the social organization of the Rush Creek phase community, any mortuary data from the Buffalo National River would have tremendous research importance. This point needs to be emphasized, because burial sites in the Ozarks, whether they occur in rockshelters or in other settings, have long been the target of illicit pothunting activities. Extra measures to protect burial sites in the Buffalo National River from such desecration would certainly be warranted.

Brown's model provides a useful framework for assessing evidence from the 1988 and 1990 investigations at the Dirst Site concerning the origins of sedentism in the central Ozarks. Following broader trends in late prehistoric cultural development affecting the midsouth, the origins of sedentism in the Central Ozarks can be traced to changes in risk-management strategies employed by populations that were adjusting to increasingly confined territories within which there were advantages to be derived from expanding and intensifying resource production. At the same time, local communities began to rely ever more heavily on networks of supralocal alliances for the maintenance of territorial integrity, acquisition of goods and information, and other social needs. The most important requirements stemming from risk-management strategies connected with these activities, at least within the central Ozarks region, appear to have involved an increased need for the scheduling and coordination multiple tasks associated with the production of basic subsistence resources and trade goods and the conduct of supralocal trade, which in turn gave rise to the emergence of institutionalized forms of leadership. In sum, the origins of sedentism in the central Ozarks can be best understood in terms of closely intertwined and nondirected environmental, demographic, technological, and social developments.

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APPENDICES

AVAILABLE UPON REQUEST

A. National Park Service Scope of Work, Arkansas Archeological Survey Proposal

B. Intercreek Testing Report, by Randall L. Guendling.

C. Accession Numbers of Illustrated Artifacts.

D. Field Specimen Catalog.

E. DELOS Listing, Excavation Units.

F. DELOS Listing, Features.

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